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THE FAR EASTERN REVIEW

ENGINEERING FINANCE COMMERCE

遠東時報

The Chinese Eastern Railway Crisis

By George E. Sokolsky

THE NEW CABINET IN JAPAN

MODERN FINANCING IN CHINA

AMERICA'S SOLDIER-DIPLOMAT

Vol. XXV July, 1929 No. 7

SHANGHAI, PEKING, TOKYO AND MANILA

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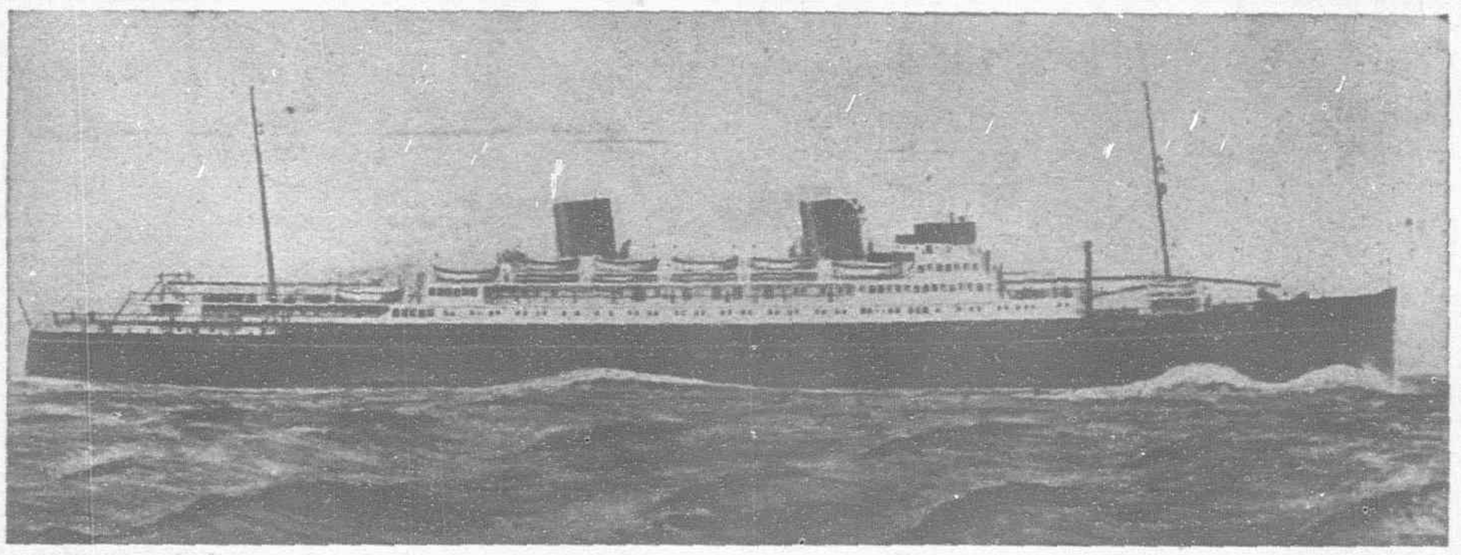

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The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXV SHANGHAI, JULY, 1929 No. 7

The Chinese Eastern Railway Crisis

By George E. Sokolsky

THERE can be no question but that both China and Russia have no desire for a war. There is equally no doubt but that neither China nor Russia are economically constituted at the moment to conduct a war on the scale which the present preparations would indicate. The current war talk is largely propaganda, designed merely to maintain national prestige, national dignity and to satisfy the more aggressive and bellicose elements in both countries. China wants peace. Russia wants peace. All Powers desire that there should be peace in Asia. Why then should there be this talk of war, these threatening gestures and denunciations, this massing of troops on the frontier ?

A little history is good for the soul. In 1924, Dr. Sun Yat-sen invited Russia to assist him in his effort to re-organize the Kuomintang and to establish the Nationalist Government. Comrade Borodin and his associates came to Canton and served with the Kuomintang, particularly in party and military service. The Kuomintang, for a time took on a Communistic complexion, Borodin and his Russian and Chinese associates spreading Communistic doctrines throughout China as part of their effort to destroy the Peking Government. This movement was wonderfully successful, so that by the end of 1926, the Nationalist armies held the whole Yangtze Valley, except the Shanghai-Nanking region which was then controlled by Marshal Sun Chuan-fang. Largely as a result of the activities of Communistically inclined students and laborers, Shanghai fell at the end of March, 1926.

It was during this period that Marshal Chang Tso-lin made his famous raid on the Soviet Embassy in Peking which resulted in a world-wide disclosure of Soviet plots not only in China but in other countries. Marshal Chang's position was unassailable, as Soviet Russia was undoubtedly and openly assisting his enemies in their effort to destroy his government by revolution. Although the Soviet Embassy was closed down, Soviet consular officers remained in China, while Chinese diplomatic and consular officers remained in Russia.

In the South, Soviet domination was found to be abhorrent by General Chiang Kai-shek. Assisted by a group of Kuomintang Generals, notably of the Kuangsi faction, he broke away from the Hankow régime and in April, 1927, he established the at that time separatist Nanking Government, as a direct protest against Soviet Russia dictatorship of the Kuomintang and the continued spread of Communism in China. He joined with him in the Nanking Government such persons as were known to be anti-Communist. The new Government entered upon a Party Purification campaign for the extermination of Communists and this had been rigorously followed to this day, sometimes with surprising brutality. Twice in Shanghai and Hankow all Russian Government economic enterprises were closed down and Russians deported. Even certain Russian advisors were arrested and detained without a fair trial and finally in December 1927, the Russian Consulates in South China were closed down, after the Communist riots in Canton during that month.

All this has been justified on the ground of national necessity. The Communist armies of Ho Lung and Yeh Ting were in South China just as the Communist armies of Chu Teh and Mao Tze-tung are operating on the Kuangtung-Fukien border now. Thousands of Communist students and laborers were agitating against the new Government, which adopted drastic measures to preserve itself.

Had Nanking failed in its anti-Communist campaign, the Hankow Government would have come under Communist domination and South China would have fallen prey to a virulent form of Communism. Even those opposed to the Nanking Government must admit that single fact to its credit.

Although the South terminated all relations with Soviet Russia, the North continued a quasi-diplomatic relationship. This was inherited by the Nanking Government when it captured Peking.

The story of the Chinese Eastern Railway is a long and ugly one. Conceived by the secret Li-Lobanoff Treaty, aimed as an offensive weapon against Japan, it has been throughout its existence a Russian political agent. It served Russian imperialism in Czarist days ; it serves Russian imperialism in Communist days. If Nanking claims that it has been used as a vehicle to spread Communism, that will surprise no one, nor will it matter much. The whole history of the Chinese Eastern Railway is a history of political service for Russia—for Russia of whatever complexion.

The vicissitudes of the Chinese Eastern Railway since October 1917, when Soviet Russia came into existence, have painted a drear page in Far Eastern history. Controlled by an Allied Commission for about a year, it eventually reverted to a Sino-Russian partnership in accordance with an agreement signed between China and Russia in 1924. There can be little question but that Russia has failed to live up to the terms of that agreement. China undoubtedly has had a grievance and a case. China would probably have won her case in any international tribunal.

The seizure of the Chinese Eastern Railway by the local Manchurian authorities has undoubtedly spoiled China's case, for it was accompanied by a rather senseless propaganda that China would unilaterally abolish extraterritoriality at the end of 1929. It is difficult to believe that the best minds in Nanking favored the seizure of the railroad or the particular form of anti-extraterritoriality propaganda which some of Nanking's statesmen were issuing. At any rate, both coming at the same time created the unfortunate impression that Nanking was growing irritable and restless and that her foreign policy was reverting to the Hankow days of Mr. Eugene Chen. Although throughout the world there is more sympathy for China than for Soviet Russia, the issue immediately narrowed itself down to the single one that whatever *changes are to be made in China's treaties and agreements, they shall be made by negotiation and not by unilateral declarations and seizures.* That the leading men in Nanking hold that view is apparent from General Chiang Kai-shek's statement that China will not attempt to abolish extraterritoriality by force.

In addition to this question, the Russians have raised the issue of the use by China of " White " Russians for political and military purposes in Manchuria and Mongolia. Attaman Semenoff's name looms large in this connection and whoever is responsible for his employment, if he is employed on behalf of China, has done his country infinite mischief.

The whole problem can thus be summarized:

1. Soviet Russia demands that the question of the Chinese Eastern Railway shall be settled by negotiation and not by seizure of the railroad.

2. China demands that Soviet Russia shall cease Communist propaganda and political activities in China.

3. Russia demands that China shall not use "White" Russians to disturb the Sino-Soviet frontier.

Surely such issues can be settled without a resort to arms! Surely there can be "peace with honor" in any solution of these questions. China needs peace and time to work out her problems of reconstruction. Russia will not benefit from a weakened and chaotic China.

All the requirements of this situation indicate the need for peace. Yet men talk of war. Both nations might practice some of the much vaunted realism of which revolutionaries boast so; both nations can easily climb down from their intransigeant altitudes; both nations can meet about a table and negotiate for an adjustment of outstanding issues with dignity and honor. There is enough right and wrong on both sides to make that politically possible.

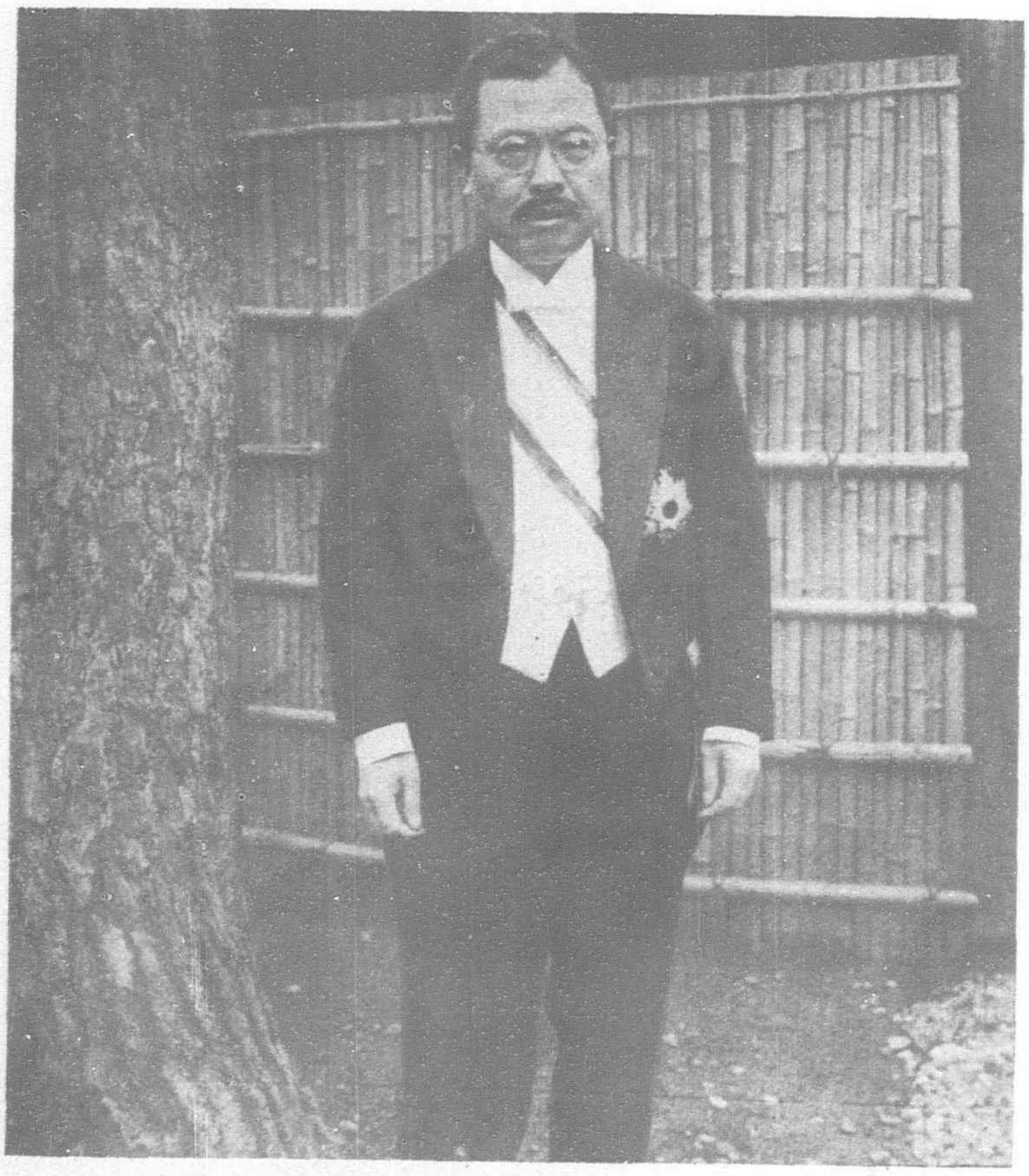
The New Japanese Cabinet

FROM the standpoint of the foreigner, the new Japanese Cabinet shows strength in its personnel, particularly in the Ministries of Foreign Affairs and Finance. The recent Tanaka Cabinet functioned without a Minister of Foreign Affairs, the Premier holding this portfolio himself. In the present Cabinet, the portfolio of Foreign Affairs has been given to Baron Shidehara, who has already won an enviable reputation for himself, not only as a Japanese diplomat but also as an independent political thinker who has been viewing Japan's position, particularly *vis-a-vis* the United States and China from a new standpoint.

Baron Kijuro Shidehara was Ambassador to the United States from 1919 to 1922, from the period of intensive anti-Japanism in America to the period immediately following the Washington Conference when the American suspicions of Japan were wholly allayed and an era of good-will and understanding ushered in. Not even a political enemy can minimize the services which Baron Shidehara rendered his country during those trying days.

The post-war political reaction in the Far East involved an intensified campaign againt Japan in the United States. Japan held the former German possessions in Shantung; Japan was protecting herself against the spread of Communism to China and Japan *via* the Chinese Eastern Railway; student demonstrations had prevented the Peking Government from signing the Versailles Treaty and inaugurated in China a fierce anti-Japanese boycott; the renewal of the Anglo-Japanese Alliance was in the balance.

Americans in China—most foreigners in China—were prone to regard Japan as an aggressive ally, who had sought to use the war situation to wrest territory on the mainland of Asia. A combination of resentment over specific acts, racial prejudice and a desire to preserve the territorial integrity of China, stirred in the United States an enmity towards Japan, rarely witnessed in a friendly country. Certain Americans in Asia and in the United States openly advocated war with Japan. It was in such an atmosphere of suspicion that Baron Shidehara won his spurs in the creation of such a friendship as exists between the United States and Japan to-day. The culmination of it was the Washington Conference, which ended forever any possible misunderstanding between the two countries and at this conference, although Baron Shidehara was not the head of the Japanese delegation, he often acted as the spokesman. And it is most interesting to note that whenever questions of China arose, it was Baron Shidehara who presented the Japanese point of view, he being regarded even then as an expert on Chinese affairs. His first speech at the Conference was short but exceedingly notable. There has been a desire to humiliate Japan by forcing her to assent to an international settlement of



Baron Shidehara, Minister of Foreign Affairs

Mr. J. Inouye, Minister of Finance

the Shantung issue—to give the appearance of a reprimand by the Powers. At the Washington Conference, Japan won the day for direct negotiations between Japan and China. Baron Shidehara in speaking on this subject, said :—

> Mr. Chairman, it seems fitting and proper that, on behalf of the Japanese Delegation, I should express the profound satisfaction which we all feel at the settlement of this long pending Shantung question.
>
> We are especially indebted to Mr. Hughes and to Mr. Balfour for the good offices which they have so graciously tendered to pave the way for direct negotiations between Japan and China with such a happy result. Their invaluable services in that direction will no doubt be forever remembered in the grateful hearts of the Japanese people, and no doubt in the hearts of the Chinese people as well.
>
> Adjustments of this kind, however just and fair to both parties, could hardly be expected in the very nature of things to satisfy every section of people in every country. What is of supreme importance, from a broader scope of vision, is that a vexatious question so long standing between Japan and China should be definitely removed.
>
> The atmosphere of unrest and tension which it has created in the popular mind must be forever set at rest. That desirable end, indeed, has been achieved fully and completely. The Governments of both countries have had to overcome various difficulties in the course of the negotiations. It may, however, be stated that both Japan and China have put forth their best efforts to secure an amicable arrangement of this question. Their efforts have now been amply rewarded. The settlement just reached will show an earnest desire to maintain and to promote friendly relations between the two neighboring nations in the Far East. It will contribute not only to their own happiness and well being, but also to the peace of the world.

Baron Shidehara was the Japanese Minister of Foreign Affairs during the trying period from 1924 to 1927, when a general

(Continued on page 301).

Modern Financing in China

Report of the Board of Trustees for the Sinking Fund of the Shanghai Customs two and half per cent. Surtax Treasury Notes

IN May, 1927 when the Chinese National Government offered the First Issue of the Shanghai Customs two and half per cent. Surtax Treasury Notes, the Board was organized in accordance with government regulations, with 15 Trustees, of whom five were elected as Executive Trustees who in turn elected a Chairman. An Executive Secretary was added later on.

The sinking funds for practically all bonds and treasury notes issued by the Chinese National Government have been entrusted to the custody of the Board ever since. Although it is known as the Board of Trustees for the Sinking Fund of the Shanghai Customs two and half per cent. Surtax Treasury Notes, in fact it is nothing other than the sole and independent organization taking care of the sinking funds for all the new internal loans of the Chinese National Government. Up to June 30 of this year the Board had in its custody sinking funds for the following ten different issues :

1. First Issue, Shanghai Customs two and half per cent. Surtax Treasury Notes.
2. Second Issue, Shanghai Customs two and half per cent. Surtax Treasury Notes.
3. Tobacco Tax Treasury Notes.
4. Rehabilitation Short-term Bonds.
5. Seventeenth Year Short-term Currency Bonds (1928).
6. Seventeenth Year Long-term Currency Bonds (1928).
7. Eighteenth Year Famine Relief Loan (1929).
8. Eighteenth Year Troop Disbandment Loan (1929).
9. Second Issue, Tobacco Tax Treasury Notes.
10. Eighteenth Year Customs Treasury Notes (1929).

The sinking funds for these notes and bonds are from the following sources :—

Six of these funds are appropriated from the increased revenue of the Customs. Among them the First and Second Issues of the Shanghai Customs two and half per cent. Surtax Treasury Notes, were, at the time of issue, secured by the revenue from the two and half per cent. Surtax collected by the Inland Tax Bureau of Shanghai; and the Rehabilitation Short-term Bonds were, at the time of issue, secured by the revenue from Kerosene oil tax collected by the Kerosene Oil Tax Bureau at Shanghai. In February, 1929 the Government altered the procedure of the collection of taxes, and ordered the 2½ per cent. Surtax and Kerosene Oil Tax to be collected by the Maritime Customs Administration. So the above-mentioned three sinking funds have since then been made from the increased revenue of the Customs.

Another fund is appropriated from the Customs surplus ; and the eighth from the returned portion of the German Indemnity (see detailed tables below). All these eight classes of sinking funds are collected by the Maritime Customs Administration. Regardless of whether the payment of interest or principal or both is monthly or semi-annual, the Board has arranged with the Ministry of Finance to direct the Inspector General of Customs to transfer the respective funds to the Board on the 25th of every month, and the Inspector General has assured the Board by letter that he will do so. The sinking funds, since then, have been regularly and punctually transferred to the Board.

The entire tobacco tax on which the sinking funds are secured is collected in two ways. A large portion of the tax under the direction of the Minister of Finance is paid directly to the Board by the British-American Tobacco Company in exchange for revenue stamps, and the remainder is paid to the Tobacco Tax Bureau which then turns it over to the Board. The funds coming from those two sources have always been more than adequate for the amount required by the sinking funds.

Sinking funds in the custody of the Board mainly consist of cash in the vaults of the Shanghai Bankers' Association Building, a portion being deposited with designated banks.

The Board publishes, once a month, a public notice in the press giving the respective amounts of sinking funds received and paid, and also engages a chartered accountant to check up once every three months the amount of cash in the vaults, and to examine the books and accounts. The Board then issues a statement of his findings in the press. When the principal or interest or both of a loan is about to fall due, the Board issues beforehand a public notice to that effect in the press, and transfers the funds required to the banks which act as paying agents.

Herewith are given the main terms (including the number of times the principal and interest have been paid, and the amounts so paid) of the various issues, for which the sinking funds are in the custody of the Board. The amounts of receipts and disbursements in connection with these issues are likewise tabulated for public information.

SUMMARY OF RECEIPTS AND DISBURSEMENTS OF SINKING FUNDS ENTRUSTED TO THE BOARD UP TO JUNE 30, 1929.

Issue	Sinking Fund Received	Principal and Interest Paid	Balance
First Issue, Shanghai Customs 2½% Surtax Treasury Notes	$29,308,000.00	$27,108,000.00	2,200,000.00
Second Issue, Shanghai Customs 2½% Surtax Treasury Notes	5,376,000.00	5,376,000.00	—
First and Second Issues, Rolled Tobacco Tax Treasury Notes	14,287,773.93	8,686,000.00* 2,004,480.00†	3,597,293.93
Rehabilitation Short-term Bonds	7,368,484.43	6,788,000.00	580,484.43
Seventeenth Year Short-term Currency Bonds (1928)...	3,853,303.89	2,100,000.00	1,753,303.89
Seventeenth Year Long-term Currency Bonds (1928)...	562,500.00	562,500.00	—
Eighteenth Year Famine Relief Loan (1929) ...	900,000.00	500,000.00	400,000.00
Eighteenth Year Troop Disbandment Loan (1929)...	2,250,000.00	—	2,250,000.00
Eighteenth Year Customs Treasury Notes (1929) ...	800,000.00	800,000.00	—

*First Issue †Second Issue

Description of the Chinese Government Notes and Bonds for which the Sinking Funds have been in the Custody of the Board, June 30, 1929

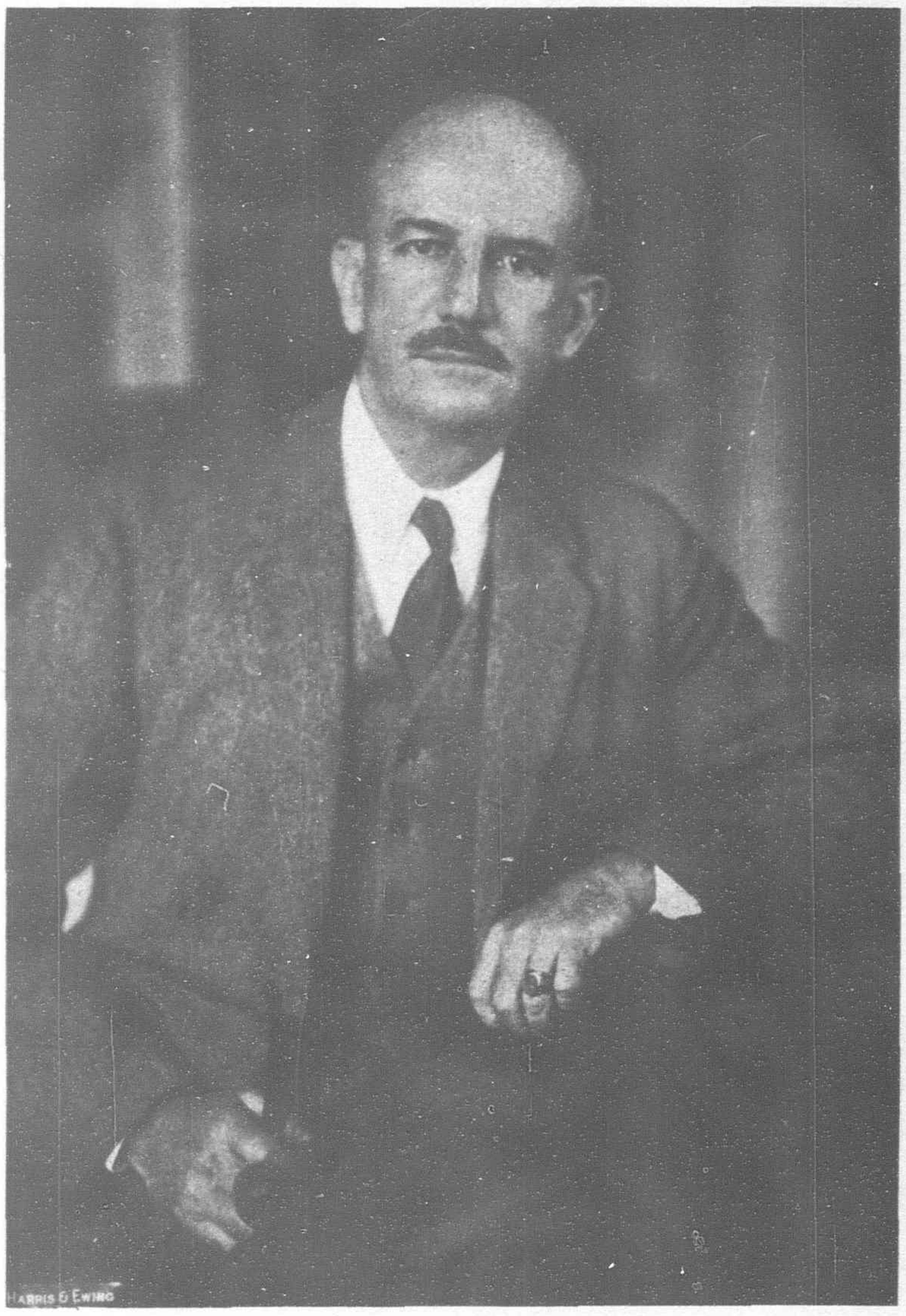
Issue	Total Amount of Issue	Date of Issue	Interest Rate	Date of Interest Payment	Redemption	Designated Securities	Denominations	Total of Principal and Interest	Number of Past Payments of Principal and/or Interest	Total of Principal and interest already paid
First Issue, Shanghai Customs 2½% Surtax Treasury Notes	$30,000,000	May 1, 1927.	0.7% per mensem (8.4% per annum)	Last day of every month	Monthly payment of interest and one thirtieth of principal since July, 1927. Redemption to be completed on December 31, 1929.	Increased collections of Customs.	$10,000 $1,000 $100 $10	$33,255,000	24 payments of principal and interest	$27,108,000
Second Issue, Shanghai Customs 2½% Surtax Treasury Notes	$40,000,000	October 1, 1927.	0.8% per mensem (9.6% per annum)	Last day of every month	Only interest paid from January, 1928 to December, 1929. Monthly payment of interest and one fortieth of principal from January, 1930, redemption to be completed on April 30, 1933.	Increased collections of customs.	$10,000 $1,000 $100 $10	$54,240,000	18 payments of interest	$5,376,000
Rolled Tobacco Tax Treasury Notes	$16,000,000	April 1, 1928.	0.8% per mensem (9.6% per annum)	Last day of every month	Monthly payment of interest and one thirty-second of principal since April, 1928, redemption to be completed on November 30, 1930.	Entire tobacco tax.	$10,000 $1,000 $100 $10	$18,112,000	15 payments of principal and interest	$8,686,000
Rehabilitation Short-term Bonds	$40,000,000	$20,000,000 on June 1, 1928. $20,000,000 ($2,000,000 withdrawn) on December 31, 1928.	8% per annum	June 30 and December 31	Redemption in ten equal installments by semi-annual drawings since date of issue, to be completed on June 30, 1933.	Increased collections of customs.	$10,000 $1,000 $100 $10	$44,480,000	2 payments of principal by drawing 2 payments of interest, the first being made at time of subscription	$6,788,000
Seventeenth year Short-term Currency Bonds (1928)	$30,000,000	October 1, 1928.	8% per annum	March 31 and September 30	Semi-annual drawings redeeming 7% yearly in first 3 years from date of issue, 20% yearly in second 3 years, and 19% in seventh year, redemption to be completed on September 30, 1935.	Surplus from cancelled German Indemnity after meeting requirements of Fourteenth Year National Loan and Continental Bank Loan.	$10,000 $1,000 $100	$40,812,000	1 payment of principal by drawing 1 interest installment pre-paid at time of subscription	$2,100,000
Seventeenth Year Long-term Currency Bonds (1928)	$45,000,000	November 1, 1928.	2½% per annum	March 31 and September 30	From 1929 to 1933 only interest will be paid. Redemption will begin in 1934 by semi-annual drawings of $1,125,000 each, to be completed on September 30, 1953.	Customs surplus.	$10,000 $1,000 $100 $10	$62,156,250	1 payment of interest	$562,500
Eighteenth Year Famine Relief Loan (1929)	$10,000,000	January 1, 1929.	8% per annum	June 30 and December 31	Redemption to be completed on December 31, 1938 by semi-annual drawings from 1929, each to redeem one twentieth of the loan.	Increased collections of customs.	$10,000 $1,000 $100 $10 $5	$14,200,000	1 payment of principal by drawing 1 interest installment pre-paid at time of subscription	$500,000
Eighteenth Year Troop Disbandment Loan (1929)	$50,000,000	February 1, 1929.	8% per annum	January 31 and July 31	Redemption to be completed on January 31, 1939 by semi-annual drawings from 1929, each to redeem one twentieth of the loan.	Increased collections of customs.	$10,000 $1,000 $100 $10 $5	$71,000,000	..	..
Second Issue, Tobacco Tax Treasury Notes	$24,000,000	March 1, 1929	0.8% per mensem (9.6% per annum)	Last day of every month	Redemption to be completed in January, 1932 by monthly repayment of 2% of principal from April, 1929 to March, 1930; 2.5% from April to November, 1930, and 4% thereafter.	Secured from date of issue to November 30, 1930 by surplus from sinking fund for First Issue of Tobacco Tax Treasury Notes, and, from December, 1930, also by said sinking fund as released by complete redemption of First Issue. In addition, customs surplus will be appropriated to cover any deficit in sinking fund required.	$10,000 $1,000 $100 $10	$27,889,520	3 payments of principal and interest	$2,004,480
Eighteenth Year Customs Treasury Notes (1929)	$40,000,000	June 1, 1929.	0.7% per mensem (8.4% per annum)	Last day of every month	Monthly principal and interest payment of $800,000 from June, 1929. Redemption to be completed in July, 1934.	Increased collections of customs.	$10,000 $1,000 $100 $10	$49,600,000	1 payment of principal and interest	$800,000

America's Soldier-Diplomat

ONE of the secrets of greatness is the ability to select competent assistants. Leonard Wood's outstanding proficiency as America's greatest colonial administrator, was due to his unerring discernment of capacity and talent in his lieutenants and trusting implicitly to their judgment in carrying through the tasks assigned to them. It is no detraction to the high qualifications of his other aides to say that in time he came to rely more and more upon the advice of Frank McCoy, than upon any of the others who as faithfully and loyally supported him at the sacrifice of active military careers. From the time that Leonard Wood was appointed military governor of Santiago, through all his subsequent brilliant career as Governor of Cuba, of the Moro Provinces, head of the Wood-Forbes Mission and Governor-General of the Philippines, he placed his full trust and confidence in the capable young officer, who is now to be promoted by President Hoover to the rank of Major General in recognition of his distinguished services in supervising the elections in Nicaragua.

The promotion of General McCoy comes as a special reward for his handling of a most embarrassing international question involving the honor and good-faith of the United States. The agreement for a supervised election in Nicaragua negotiated by Henry L. Stimson, was interpreted throughout Latin-America as a ruse for the United States to further its imperialistic designs upon a smaller and weaker neighbor. The appointment of an American army officer of high rank to direct the elections and the presence of a large body of marines to police the polling places, only helped to strengthen this belief.

When General McCoy arrived in Nicaragua he found an atmosphere charged with deep distrust of the United States. When, after organizing his electoral machinery and discharging his mission successfully, he departed for home, the Managua Municipal Council headed a subscription to raise funds for erecting a statue to the American General to commemorate his impartial supervision of an election which brought peace and harmony to a war-distracted people.



America's Soldier-Diplomat, Major General Frank R. McCoy

For many years, General McCoy was the trusted aide and adviser to Major General Leonard Wood. He headed the American Relief Mission at the time of the Great Earthquake which destroyed Tokyo and Yokohama in 1923 and laid the foundations of that new spirit of friendship and understanding that characterizes the present relations between Japan and America. He has recently been promoted by President Hoover to the rank of Major General for his distinguished services in successfully supervising the Nicaragua elections. He is now Chairman of the Commission to Mediate the Boundary Dispute between Bolivia and Paraguay.

General McCoy's experience in Cuba, Mexico, Philippines and Nicaragua led the President to appoint him to represent the United States on the board of mediation to straighten out the boundary tangle between Bolivia and Paraguay. His associates on the board promptly elected him as their chairman. He is now presiding over the sessions of the board where his intimate knowledge of Latin-American temperaments will undoubtedly bring to him further honors and rewards.

To his many friends in the Far East, the action of President Hoover in rewarding his distinguished services will be hailed with hearty applause. Those who know something of the inside story of how the strained relations between Japan and the United States were placed on an enduring basis of friendship and understanding at the time of the Great Earthquake of 1923, realize that the credit was due largely to the tact and diplomacy of General Frank R. McCoy, in charge of the American Relief Mission.

We know of no situation in the history of our Far Eastern relations which required such delicate handling as the one which sent the American fleet and army transports hurrying to Tokyo Bay laden with relief supplies and placing their distribution unconditionally under the supervision of a general officer of the American army. One false move, one slight assumption of superiority, one word or phrase that might be misconstrued and the whole effect of the generous response of America to the urgent needs of a proud people would have been lost. That such a complete understanding resulted from the contact of the American Relief Mission with the Japanese authorities and leading men in all walks of life, is due in large part to the scrupulous concern for the Japanese viewpoint adhered to at all times by General McCoy and Ambassador Woods. The people of America have perhaps forgotten the great disaster which devastated Eastern Japan in September, 1923, but the horror of those dark days of suffering, grief and despair is graven deep in the memory of the Sons of Nippon. They remember. In their niche of fame will be found the name of the two Americans, who more than any one else, helped to turn the calamity into a blessing; Ambassador Cyrus Woods and General Frank McCoy.

Although General McCoy's success in Nicaragua justly entitles him to special reward, we hold to the belief that his most distinguished and valuable services to the nation were connected with his career in the Far East. In September, 1921, when Major General Leonard Wood passed through Tokyo on his way to the United States after concluding his investigation of Philippine affairs, he had a series of heart-to-heart talks with Major General Baron Tanaka and the other military leaders of Japan, in which both sides frankly laid their cards on the table. Up to that moment, Japan had hesitated about accepting President Harding's invitation to send delegates to the Washington Conference, fearful that her rights and position in Manchuria would come up for discussion; an interference that Japan would not tolerate. The spokesman for Japan very clearly and emphatically explained the position of his government in

regard to Manchuria and expressed a determination to fight if these dearly bought rights were interfered with by any other Power. General Wood just as clearly and firmly explained that the United States would resort to hostilities in the event that Japan persisted in fortifying the outlying chain of islands enclosing the Yellow and China Seas, which might at any given moment cut off American commerce or intercourse with China and the mainland of Asia. Other subjects relating to disarmament were discussed, but the friendly understanding arrived at between the military leaders of America and Japan by a frank round-table discussion of their irreducible minimum for peace, cleared the surcharged atmosphere and made possible Japan's attendance at Washington and her acceptance of the American program for naval disarmament and the supplementary agreements concerning China. Colonel Frank McCoy participated in these friendly conferences as General Wood's associate. Leonard Wood has passed away. General McCoy remains as the one American army officer of high rank whose wise counsels, tact and discretion, paved the way for peace in the Pacific.

It was a stroke of good fortune for both nations, that the great earthquake of 1923, found General McCoy at Shanghai, *en route* to Manila, when the first news of the catastrophe was flashed over the cables. He at once advised his chief that he was returning to Japan to render such assistance as was possible and, in reply, was ordered to head the relief work as the official representative of the American Red Cross. His splendid handling of this delicate mission fittingly supplemented his previous labors in behalf of peace and good understanding. The American Relief Mission to Japan broke down and swept away all the remaining barriers between Japan and the United States. It ushered in a new era in the Pacific. It laid the foundation for that spirit of cordial friendliness, of complete understanding and close business co-operation which to-day characterizes the relations between the two nations.

Leonard Wood will live in history as the greatest soldier-executive our country has produced ; his chief aide and trusted adviser has become in a few years, the foremost soldier-diplomat of the nation.—G.B.R.

MANCHURIA

[The following chapter is taken from " Progress in Manchuria," 1907-1928, published by the South Manchuria Railway]

MANCHURIA lies in the northeastern extremity of China. Parts of Russian Siberia and Japanese Korea form its northeastern boundary. Its area, covering about 382,000 square miles, is almost the same as that of Egypt, or the aggregate area of Texas and New Mexico in the United States ; it is almost half the size of Mexico, or more than three times the size of Japan proper. The population of Manchuria in 1927 was variously estimated at from 23,000,000 to 27,500,000. It is now steadily and rapidly increasing owing to the constant inflow of Chinese immigrants.

The natural resources of Manchuria, in contrast with those of other parts of China, are rather rich, especially the agricultural, mineral, and forestry products. Arable land, covering about twenty-five per cent. of the total area, is of the most fertile soil, and many areas were virgin and awaiting development. Manchuria was in fact a " Forbidden Land " for many generations, not only to the world at large, but, more particularly to the Chinese themselves. The fame of Manchuria, though its economic possibilities were so great, was not well known until it became the battlefield of nations. This was, first, during the Sino-Japanese war of 1894-5 and, second, during the Russo-Japanese war of 1904-5. After the Sino-Japanese war, the Russians opened up portions of Manchuria by building the Chinese Eastern Railway. But it fell to the Japanese after the Russo-Japanese war, to make Manchuria a land of opportunity of the world, in co-operation more or less with China, Russia and other countries.

Peace and Order

By the Russo-Japanese war, the Russian Pacific Fleet with her Baltic Fleet was practically annihilated. Subsequently most of the main squadrons of the other European Powers were withdrawn from Oriental waters and concentrated in the North Sea and Mediterranean Sea. After the Russo-Japanese war, a period of tranquility set in throughout the Far East. As to Manchuria, more enduring peace and order being fortunately maintained, the development and progress effected in this region during the past two decades were by no means inconsiderable, while revolutions, civil wars, or other political disturbances were unfortunately as frequent in China proper, after the establishment of the Republican régime, as at any time in the past. Indeed, Manchuria was the only region in the whole vast area of China which offered the benefits of peace and order to the calamity-stricken people of Shantung, Chihli and Honan, who were driven out by famine and warfare, and tax extortion, prevailing specially during the civil war of 1926-8. Order in Manchuria has thus been preserved for nearly a quarter-of-a-century, since the Russo-Japanese war, without serious interruption, despite the frequent forays of Manchurian bandits upon isolated settlements. This has been achieved principally with the aid of the Japanese troops, while the military authorities of the Three Eastern Provinces, particularly Grand Marshal Chang Tso-lin, also played an important part in the maintenance of peaceful conditions. The railway guard of the Chinese Eastern Railway, one of the important factors in the maintenance of peace in North Manchuria, were formerly Russians, who were replaced by the Chinese in 1922. According to the annual report of this Railway, it pays to the Chinese guards each year from 3,500,000 to 4,100,000 roubles, which sum is recorded under the head of " Expense for the Chinese Government offices." Participating in the maintenance of order in Manchuria is costly to Japan. Though the number of railway guards is reduced to less than that allowed by treaty, Japan still has to spend more than Y.15,000,000 a year on soldiers and police in the Railway Zone and Leased Territory. And, in times of crisis, when civil war or other disturbance threatened the peace and order in Manchuria, in a way calculated to affect Japanese interests, the military expenditure increased. Maintenance of peace and order in Manchuria is vitally important, particularly to Japan, whose investments in the territory amount to some Y.2,000,000,000 ; the territory is increasingly becoming the chief granary and source of raw material for Japanese industries. Japan has thus vital relations with Manchuria. In a broader sense, historically and politically, Japan cannot permit any repetition of the bitter experience of the past—any disturbance of Manchuria which would affect the security of Korea and Japan, and ultimately the general peace of the Far East. Furthermore, 1,000,000 Japanese subjects including 760,000 Koreans have their homes in Manchuria to-day. Japan would thus not be doing her duty in allowing Manchuria to become involved in any serious disturbance of tranquility.

Railways

The railways in Manchuria have played a most important part in its development, as they do elsewhere. More than three thousand miles of railways have been built in Manchuria since 1897, while little over five thousand miles have been built in the vast territory of China proper since 1877. Of the total in Manchuria, China owns about half, Russia one-third, and Japan the balance. The Chinese railways, though aggregating a greater mileage than the Japanese or Russian, were mostly financed by foreign, specially by Japanese, capital ; while the Manchurian section of the Peking-Mukden line, between Mukden and Shanhaikwan, with branch lines, was built with British capital. Until quite recently, the agricultural crops were transported by means of the inadequate waterways, and by the primitive Manchurian cart, but the railways are to-day carrying every year larger numbers of immigrants and great stocks of agricultural products and other staples. Especially the South Manchurian Railway, running through the heart of Manchuria, with

a terminal at the highly improved port of Dairen, and connecting with the railways running to China proper, Korea and westwards to Europe, is playing the most significant part in the remarkable growth of the agricultural produce and in the stupendous development of the international trade of Manchuria.

The activities of the South Manchuria Railway Company in coal and iron mining and other industries are not only augmenting the supply of agricultural and mineral products, but also providing exployment for hundreds of thousands of Chinese, who have been attracted to Manchuria from the neighboring provinces, chiefly from Shantung.

Growth of Production

The railways being gradually developed, and peace and order maintained, agricultural, mineral, forestry and other industrial developments made steady progress, greatly aided by ample supplies of labor, due to the constant inflow of Chinese coolie immigrants and ready capital, mainly Japanese. In 1915, the estimated production of soya beans, kaoliang (a sort of sorghum), millet, wheat, barley, oats, rice, etc., amounted to 404,500,000 bushels. Twelve years later, in 1927, these crops were estimated at over 786,800,000 bushels. The soya bean, to-day commanding a world-market and kaoliang, used as the staple food of the native populations and also as cattle fodder, are the most important among agricultural products. The production of soya beans to-day, amounting to about 190,000,000 bushels, or 5,400,000 tons, has doubled during the last twelve years, while production of kaoliang, amounting to 184,000,000 bushels, has remained stationary. The cultivation of kaoliang has given place to that of the bean in many districts. The tradal importance of the soya bean and its products —oil and cake—has made Manchuria famous. They are so predominant that they now constitute more than one-half the value of the entire export trade of Manchuria. Of 4,407,000 tons of beans and bean products exported in 1927, a little less than one-half went to Japan, about 30 per cent. to Europe, 12 per cent. to China, and the rest to the United States and other countries. Next to beans, millet is the important crop to-day, producing 143,000,000 bushels every year, of which about 13,000,000 bushels were exported exclusively to Korea in 1927. Korea, notwithstanding a deficient rice supply, exports rice to Japan proper amounting to 31,000,000 bushels, and imports the Manchurian millet and cheaper grade of Indo-China rice as a substitute for the rice deficit. As the Manchurian bean and beancake, imported to Japan as foodstuff and fertilizer, are to-day helping in the solution of the national food question of Japan, Manchurian millet affords the same service to Korea.

Expansion of Trade

The trade of Manchuria with other countries remained insignificant for many years, as the region was undeveloped and Newchwang was the only Manchurian port opened to trade. But the Russo-Japanese war, which marked a new epoch for Manchuria, preceded a most radical change in the tradal situation, particularly after the opening of the port of Dairen. Prior to the war, Japan and the United States took the initiative in opening additional ports in Manchuria, such as Antung and Mukden. Japan secured from China by formal agreement her consent to the opening of sixteen places in Manchuria, including Harbin, Manchuli, Aigun, Suifenho, Liaoyang, etc. China, after first opening Antung on March 1, 1907, formally opened nine other important towns including Harbin, Mukden and Manchuli by 1911. In July, 1907, Dairen in the Leased Territory, was opened by Japan as a free port. In the year Dairen was opened, the total trade of Manchuria was valued at Hk.Tls. 52,000,000, *i.e.*, 6 per cent. of the total trade of China. In 1927, this was increased to over Tls. 676,000,000, *i.e.*, 21 per cent. of China's total trade. Of this amount, Tls. 376,420,000 belongs to Dairen. That is to say, the trade of Manchuria itself expanded more than twelve times in the last 21 years, and Dairen's share amounted to more than 50 per cent. of Manchuria's total trade. Manchuria has one bright aspect in its trade in that it maintains an excess of exports over imports in most years, contrary to the trade in China proper, where imports invariably exceeded exports, as in Japan and Korea.

Of the total exports for 1927, amounting to Tls. 408,000,000 Manchurian beans and derivatives occupy more than half, or Tls. 215,000,000. As already stated, Japan is the heaviest purchaser of these products. Europe and America bought over 30 per cent., and there is a strong upward tendency in the overseas market in supplying chemical industries and for cattle feed.

Regarding the import trade of Manchuria, cotton goods are still the most important item. Total imports for 1927 aggregated Tls. 268,000,000 of which Tls. 67,000,000 represented the share of cotton goods, including yarn. Of the cotton imports, Japan's share is about 53 per cent. and China's share 42 per cent. When Newchwang was the only open port in Manchuria, England maintained a virtual monopoly of the import of cotton goods, and later the United States attained the leadership in this trade. Japanese cotton goods were first imported several years before the Russo-Japanese war, but to a rather negligible amount. The Japanese industry in those days was not in a position to compete with either British, American, or Indian mills. Japan's strenuous but constant efforts to develop this industry, specially after the Russo-Japanese war, were gradually crowned with success. Moreover, Japan's geographical position, and her ability to produce a much cheaper staple by mixing raw materials of the American higher grades and those of Indian and Chinese lower grades, ultimately secured the market. Before the outbreak of the European war, the imports of cotton goods, except of the best qualities, were almost wholly supplied by Japan. The war temporarily crippled the cotton mills in Western countries and also ocean transportation and at this period, Japan enjoyed complete supremacy in this trade in Manchuria. After the war, goods manufactured in China proper gradually increased, and they now represent 42 per cent. next to those of Japan, as already stated.

It must be remembered, however, that the increased importation of Japanese cotton goods into Manchuria means that the Japanese mills must buy more raw cotton from America, India and China. Nor does the falling off in the imports of British and American cotton goods affect adversely the total of their imports into Manchuria. On the contrary, the trade of both Britain and the United States has increased in other departments. Imports of machinery and other iron manufactures from America and Europe have steadily increased. Since the South Manchuria Railway Company entered the field, there has been a steady demand for supplies of iron manufactures for mines, iron works and other industrial undertakings. Imports from the United States, including the Philippines, amounted to Tls. 6,775,000 in 1908 and were increased to Tls. 17,638,000 in 1927; while those of Great Britain and dependencies increased from Tls. 2,693,000 to Tls. 17,734,000 during the same period. German imports increased from Tls. 150,905 to Tls. 5,469,000. Moreover, the foregoing probably do not represent the total figures ; they are the Customs returns, which do not include goods shipped to Japanese ports and Shanghai and thence reshipped to Manchurian ports.

In the trade of Manchuria, as a whole, Japan still maintains the supremacy gained in imports as well as in exports, but she purchases more than she sells. While American and European trade in Manchuria also markedly increased during the last two decades, those countries sold more than they bought, with the exception of Denmark, Holland and Italy, which are large buyers of soya beans. Manchurian trade with China proper has steadily grown since the European war.

Chinese the Chief Beneficiaries

Historically, politically, and economically, Manchuria in which China's sovereign right is safeguarded, is internationally concerned more particularly with Japan and Russia. Yet the Chinese themselves are the chief beneficiaries, so long as peace and order are maintained and the development of the country continues. Manchuria was liberated from Russian military control after several years of actual occupation by the forces of the Czar, and outside of the leased territories and the railway zones, the administrative entity was restored to China. Ever since, order in Manchuria has been preserved without serious interruption. While people in the central part of China suffer from frequent disturbances, the Chinese in Manchuria enjoy the benefits of peace and prosperity. As already stated, an extensive railway system has been constructed which has proved a very important factor in developing Manchuria. This not only conveys Chinese travellers and immigrants with safety, but the farmers' harvests to waiting markets. The South Manchuria Railway Company in its various undertakings, railways, harbor, mining, etc., employs less than 12,000 Japanese, and over 13,600 regular Chinese workers, besides sixty thousand coolie day-workers. While the Company paid Y.22,000,000 to share-

holders as dividends in the fiscal year ending March 31, 1928, the aggregate amount of wages paid was Y.26,450,000, of which 75 per cent. went to the Chinese. Probably ten or twenty per cent. of the earnings of the Japanese employees might be sent to Japan for the support of their families, but the remainder of their earnings is practically spent in Manchuria, and the bulk of it goes into Chinese pockets. Along with the extension of railways and the development of the country, the products of Manchuria have been stupendously increased in the last two decades, which have converted Manchuria into an exporting country. The result of these combined advantages is seen in a marked improvement in the standard of living of the Chinese. Before the Russo-Japanese war, bean oil was generally used for lighting purposes, and sugar was regarded as a luxury or medicine. But, in recent years, the imports of sugar and petroleum have increased year by year. The womenfolk in bygone days wore heavy imported cotten piece goods, weighing 17-8 pounds per bolt, but now the weight of such goods has been reduced to 12-3 pounds, which is significant of the improvement in the general condition of living.

More Co-operation Needed

As noted already, Manchuria, though the object of much international attention, has none-the-less made marked progress during the past two decades. Should China, more particularly the authorities of the Three Eastern Provinces, and the foreign Powers concerned, especially Japan and Russia, co-operate more fully in the development of Manchuria, instead of prejudicing their respective interests by international jealousies and cut-throat competition, or by incurring occasional boycotts by the Chinese, which have been productive of so much harm to all in the past, it would promote the respective interests of every nation concerned, and would improve the moral and material well-being of the Chinese.

After the war with Russia, Japan, in the development of her acquired interests in Manchuria, upheld the principle of equal opportunity for all nations and endeavored to work in the spirit of co-operation and conciliation, particularly so in her dealings with China and Russia. She opened in 1907 the port of Dairen in the Leased Territory as a port free to all nations. When the South Manchuria Railway Company was about to be formed in 1906, Japan invited the Chinese Government and individuals to take over any part of the stock offered for public subscription. But the offer was ignored in silence, and China thus lost an opportunity of participating in what it was expected would be a profitable undertaking. Fortunately, a number of Sino-Japanese joint undertakings in iron and coal mines, the lumber industry, waterworks and electric plants, railways, produce exchanges etc., subsequently were formed. International traffic being an important aspect of the work of the South Manchurian Railway, the Company made constant efforts to establish international through traffic, particularly in co-operation with the railways of China and Russia. When Baron Goto (now Count), the first President of the Company, went in May, 1908, to Petrograd on a visit of courtesy, he took the initiative in arranging for direct through traffic between the South Manchuria Railway and the Chinese Eastern Railway, which connects with the Russian line to Europe. When the reconstruction of the Antung-Mukden line was completed in 1911, an arrangement for international through traffic for passengers and freight between the South Manchuria Railway and the Peking-Mukden Railway of China was made. At intervals since, the so-called Interlines Conferences between China and Japan and Russia have been held and much benefit has been derived by all parties from these meetings.

In the development of Manchuria, the co-operation of foreign capital and skill have played an important part. Most of the railways were built by foreign Powers or by the co-operation of foreign capital. During the period of reconstruction and improvement of the South Manchuria Railway, the Company on several occasions issued debentures, aggregating £14,000,000 on the London market, and purchased rails, locomotives and other rolling stock in large quantities from the United States. The Russians built the Chinese Eastern Railway mostly with French capital, while the Manchurian section of the Peking-Mukden line of China was built principally with a British loan amounting to £2,300,000. Several Chinese lines in Manchuria were built with Japanese capital. Japan, though she may object to lines being built parallel to or in other ways seriously prejudicial to the interests of the South Manchuria Railway, is quite willing to invite foreign capital to participate in the development of Manchuria. The Japanese Government formerly held the preferential right to grant loans for railway construction in South Manchuria and Eastern Inner Mongolia, and also for other purposes in these regions, but Japan voluntarily renounced certain parts of this preferential right in a statement made at the Washington Conference, and threw the field open to the joint activities of the International Consortium. In the spring of 1928, when the newspapers reported that the South Manchuria Railway contemplated the issue of a foreign loan for the further development of its iron works, coal mines, and other enterprises, it is said that the project was objected to by certain Chinese who feared such a loan would prejudice Chinese sovereignty in Manchuria. Such fear or suspicion seemed rather sentimental and superficial. Americans for generations past have demonstrated their co-operative talents by introducing British and other European capital in opening up their vast continent, as also in the development of the extensive international co-operative interest in Mexico. Such was also the case with the industrial development of Japan, where foreign capital was liberally used for a quarter of a century. Such industrial co-operation in the past has not affected in any way national independence or territorial integrity, as is sometimes feared in China.

The most dreadful visitation of bubonic plague has more than once been experienced by the people in Mongolia and Manchuria. But co-operative measures for preventing the spread of the plague in Manchuria, promptly undertaken by the Chinese, Japanese and Russians have proved of real benefit over the whole vast area. The lesson taught by this single instance of co-operation is suggestive of the value of co-operative effort in promoting the welfare of Manchuria as a whole.

The present Report, though describing succinctly the geographical features of Manchuria and the country's history, chiefly referring to its international relations, as the necessary background, is intended to deal more in detail with the material and moral progress effected during the last two decades. It is, however, a matter of regret that the statistical records of parts of Chinese and Russian activities are not as readily accessible as those relating to the Japanese.

Some Aspects of Permanent Way Maintenance in Japan

SPEAKING at the annual winter meeting of the Permanent Way Institution Mr. Tamiya Nagata said that the honor which had been done him by his election as a Fellow was something more than a personal one. It was already regarded by his London colleagues, and would be regarded by his colleagues in Japan as an honor to Japanese railwaymen, and colleagues in Japan as an honour to Japanese railwaymen, and would add another link to the bonds of cordial relationship and friendship which had so long existed between the railwaymen of the two Island Empires of the East and West.

Mr. Nagata then read a paper, entitled "Some Aspects of Permanent Way Maintenance in Japan," from which we make a few excerpts.

It is interesting to note that Japan owes the construction of her first railway to a British engineer, Mr. Edmond Morel, who was chief construction engineer of a short line of 18 miles between Tokyo and Yokohama. This line was opened in 1872, and in the fifty-six years which have elapsed since that auspicious occasion the Japanese railways have made wonderful progress, the mileage having been added to year by year. At the end of last March,

which is the end of our fiscal year, the total mileage was 8,322 miles, and every year about 300 miles are added. There are 687 miles now under construction, and preparations are being made for the construction of 2,126 miles, which have been sanctioned by Parliament. The gauge of all the Japanese lines is 3ft. 6in.

Owing to the topography of Japan being exceedingly complex and mountainous in character, there are many sharp curves and steep gradients. In fact, nearly 30 per cent. of the mileage is on curves of various radii, and more than 30 per cent. is on gradients steeper than 1 in 100, whilst long sections of 1 in 60 and even 1 in 40 are not rare. In recent years, however, the regulations have stipulated the minimum radius of curvature to be 15 chains, while all gradients have been avoided as far as possible.

The maximum axle load of locomotives which run on our lines is limited to 14.763 tons, as against 17.715 tons on special lines. The average weight of the larger locomotives in service on the main lines is now well over 120 tons, but owing to the narrow gauge and the prevalence of sharp curves and steep gradients, the running speed of the trains is under 50 miles per hour.

Rails.—The rails in use are mostly 60 lb., 75 lb., and 100 lb. per yard, all the last-named being flat-bottomed. With regard to the type of rails, in the 60 lb. and 75 lb. rails, there are many of the A. S. C. E. type, whilst rails of the old British standard type are also well in evidence. The 100 lb. rails are the Pennsylvania section type.

The standard length of our rails has been 33ft. for many years, but recently we commenced experimenting with 39ft. for the 100 lb. rails. For more than twenty years we have been gradually using home-made rails, and nearly half the rails now laid down are home-made. But, even now, we cannot say that the importing of rails from Great Britain, the Continent, and America has ceased.

The quality of the steel of our rails is the ordinary carbon steel of basic or acid converter and open hearth, and mostly contains carbon from 0.22 to 0.51 per cent. We are now also experimenting with sorbitic rails and British-made alloy steel rails.

Sleepers.—With the exception of steel sleepers used in the Abt rack section in our most mountainous region, our sleepers are mostly of timber, 8in. wide, 5½in. thick, and 7ft. long. The number usually used for the 33ft. rail is fourteen or fifteen on the main lines and thirteen on the sidings. The timber is mostly chestnut, but pine, shii (*Pasania cuspidatea*), and nara (a kind of oak, *Quercus glandulifera*), are also used. Formerly all were untreated, but during the last fifteen years creosoted sleepers have been interspersed. The sleepers for bridges, points and crossings are of special sizes, and the timber used is mostly hinoki and hiba (a kind of cypress). All these sleepers are of home-grown timber, but besides these we are experimenting with metallic sleepers, reinforced concrete sleepers, and also utilizing scrap rails to produce sleepers. Although our sleepers are now mainly of timber, our supply is limited, and it is strongly felt that, as our mileage increases, we shall inevitably have to use metallic sleepers, and investigation and research on this point are now being strenuously carried on.

Road Bed.—The usual breadth of the road bed is 16ft., and, except in special cases, the bed is the natural soil untouched. In special cases, in the districts of severe cold, rubbles are used to prevent the upheaval of the soil by frost.

Bridges.—The total number of bridges is 26,314 and their aggregate length is 240 miles, which corresponds to 2.9 per cent. of the total length of the open lines. Owing to topographical conditions of our country, very long span bridges are very rare. The longest bridge is 4,077ft., and the longest truss is 300ft. Formerly all the girders were imported, but of late the girders are mostly of home-made materials, and they are almost wholly made in the home workshops.

Organization of Permanent Way Work

Under the Minister of Railways at Tokyo, the Ministry is divided into several bureaux. The total area of the railways is divided into six regions, which roughly correspond to the four great railway companies in this country. Each of the regions has its own head office in the principal town of the region, and is under the control of a director.

The permanent way is controlled by the Ministry through the Bureau of Maintenance and Improvement, which has four Departments, *viz.*, Maintenance, Planning, Improvement, and Building. The Bureau has charge of the design and execution of the permanent way work, the preparation of materials, and also the various investigations and experiments. The actual work of the permanent way, however, is executed under the control of the director of each region. Each region has a Maintenance Section, which has charge of the planning, design and adjustment of the permanent way work within its area. Distributed throughout the six regions there are thirty-eight division maintenance offices, which act in conjunction with the division traffic offices, each controlling about 200 miles on an average. Under these division maintenance offices there are maintenance section offices, each of which controls about 50 miles on an average, and also has charge of the inspection and repair of tracks and buildings.

Under the chief of each maintenance section office there are two assistant chiefs—one for maintenance and the other for construction. These maintenance section offices are subdivided into sub-sections of about 10 miles each, under a resident superintendent in charge of each subsection. They are responsible for the distribution, control, and encouragement of the daily maintenance work. Under them, the lines are portioned, in stretches of about 3½ miles each, to a ganger and his gang and they devote themselves entirely to maintenance.

Besides the above, there is generally attached to each subsection an assistant superintendent, who has the special duty of inspecting the track, noting the manner of working and the diligence and slackness of the gangs, inspecting the bridge guards and level crossing guards, and sometimes in important work even leading the gangers and their gangs.

At the end of the last fiscal year, March 31, 1928, the total number of permanent way men was 28,139, and their aggregate salaries and wages amounted to £1,749,853, which corresponds to about 37 per cent. of the total permanent way maintenance expenditure for the year of £4,771,476. More than 60 per cent. of this sum went for the maintenance of the track alone, *viz.*, £3,023,687. The average maintenance expense per mile of track on the main lines last year was £310.

The phenomenal increase in traffic, which recently doubled itself within ten years, necessitated heavier and more powerful engines, but there were many tunnels and bridges not suited for such heavy traffic. It was therefore resolved to improve these structures to meet all possible requirements. Although this work was tackled with all our power, it was found necessary in very many cases to reinforce temporarily structures to allow the traffic to proceed. This rebuilding is one of the big features of our work.

Similarly with the rails, their fatigue is so tremendous that we are forced to change to heavier rails, and this work is also proceeding according to our annual plan. In connection with this, much research and investigation is being done to find the right quality suited to the climatic conditions and train operation of our country. So far we have adopted nearly the same quality as specified in the British standard specification.

River Pebble Drags.—Owing to the number of accidents which occurred through trains over-running the buffer stops, experiments were set on foot to devise some safer plan. It was finally decided to adopt, as the standard, a system which we call "River Pebble Drags," somewhat resembling sand tracks in operation without rails. The length of these drags is 131ft. 3in., 98ft. 5in., and 65ft. 7in., depending upon the approaching gradients. In ordinary cases, the thickness of the pebble drag is 9¾in., both upon and below rail level; that is, the total thickness is 19½in. In other cases, where it is considered to be inconvenient to bank the pebbles above rail level, the thickness of 19½in. of pebbles is placed only under rail level. In one instance, for example, a train composed of an engine and thirty-nine cars ran into a river pebble drag, banked to a height of 15¾in., at a speed of 34-4 miles per hour, with the result that the leading wheel of the engine stopped at a distance of 95ft. 2in. from the beginning of the drag within 3-1/5 sec.

The Human Element.—The best example of the efficiency of the human element on Japanese railways comes from the Great Earthquake in 1923. Faced with such a big emergency as the death of over 100,000 people, with every communication from or to Tokyo entirely stopped, with 179 miles of track totally destroyed, and many bridges and tunnels collapsed, from every region there hurried engineers and permanent way men, over land, on foot or by sea, to the devastated sites, and without sufficient food and with scarcely any sleep or rest, they tackled their big job of repair with such skill and energy that within twenty-one days the most important trunk line was again fully opened.

Work of the National Highway Planning Commission

THE National Highway Planning Commission recently concluded a three months' conference in Nanking under the auspices of the Ministry of Railways. On January 8, 1929, the ministerial order for the organization of the said commission was published and notification was sent to all the provinces ; each respective province was requested to delegate a member of the staff of the Provincial Commission of Construction to the conference in Nanking, which was scheduled to meet on February 20. The commission was to be constituted by these provincial delegates and three members appointed directly by and from among the staff of the Ministry of Railways.

By February 20, nineteen of the provincial governments appointed their delegates, all of whom were responsible members of their commissions and a majority of them were able to report at Nanking in time for the opening of the conference. The three members appointed by the Ministry of Railways were Mr. Y. S. Chun, Director of the Planning and Construction Department of the Ministry, Mr. T. King, Technical Expert of the Ministry and Mr. Y. M. Lin, Director of the Nanking City-Planning Bureau. Mr. Chun was designated chairman of the commission.

At the first session which took place immediately after the opening ceremonies, a resolution was passed to divide the work of the commission into four parts, and to organize four committees. The duties of the various committees are as follows :

The first Committee shall take charge of selection of lines and the formulation of a program of construction.

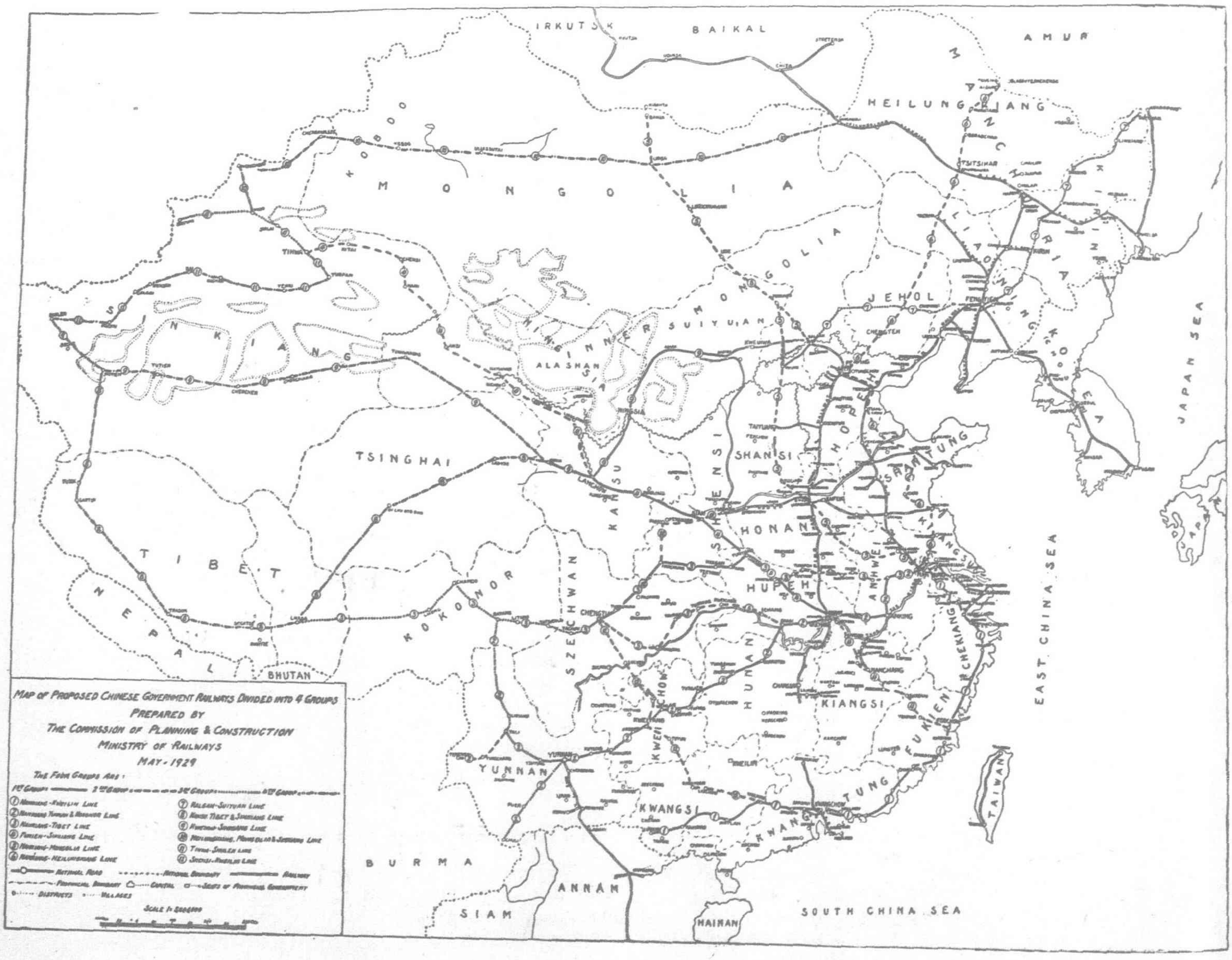
The second shall attend to standardization of designs and specifications.

The third shall tackle the financing and transportation problems and the organization of construction offices. And

The fourth shall take up the question of employment of disbanded soldier labor ; legal and other matters not specifically assigned to other committees.

Each committee was to separately work out its own problems and bring out its proposals on assigned subjects and to submit them to the conference for examination discussion and adoption. Every member of the commission was to be appointed to a special committee, but in no case should a member serve in more than two committees.

After three months of concerted work and careful deliberation in co-operation with the staff of the Planning and Construction Department, the conference having its major problems solved, was formally adjourned on May 23, 1929. The National Highway



Planning Commission, having submitted its plans to Minister Sun Fo for authorization and execution, was automatically dissolved. Among these plans, perhaps the selection of lines and the program of construction are of the greatest importance and interest.

The Standardization of Line Selection

The national highways were divided by the Commission into two classes, namely ; the China Proper Lines and Frontier Defence Lines. The latter were selected solely from the viewpoint of national defence, while the selection of the former designed to connect the different provincial capitals with Nanking was guided by the following principles ;

1. They should traverse the most populous and the most productive districts.
2. They should pass through the most important commercial centers of the provinces.
3. They should act as feeders to the railway lines.
4. They should be the most economical both in the cost of construction and in maintenance.
5. Provincial highways either already in existence or definitely scheduled for construction should be linked together to become national highways, if their importance so warrant.
6. Projected railway lines, if not likely to be built in the near future, may be first built as national highways.

After much careful deliberation and discussion, the following twelve lines were finally proposed for projection :

Description of the Projected National Highways

1. Nanking-Kwangsi Line—This line extends from Nanking to Lungchow, Kwangsi *via* Kuyung, Ishing, Changshing, Huchow, Hangchow, Shaoshing, Taichow, Wenchow, Foochow, Hinhwa, Chuanchow, Changchow, Chaochow, Haifeng, Lufeng, Canton, Shiuhing, Wuchow, Yuling and Nanning. It incorporates the provincial highways of Kiangsu, Chekiang, Fukien, Kwangtung and Kwangsi, linking together the most important cities of the five provinces. From Nanking to Canton, the route followed is far apart from the proposed Nanking-Canton Railway, and for the rest of the line only the short section from Canton to Wuchow is paralleled by the projected Canton-Yunnan Railway. This line is also important from the standpoint of national defence for the southeastern coast.

2. Nanking-Yunnan-Sikang Line—From Nanking to Kunming *via* Pukow, Luchow, Anking, Hankow, Hanyang, Shasi, Changteh, Chenchow, Tungjen, Yuping, Yungan, Kweiyang, Anshun, Panhsien and Chuching ; from Kunming, one line to Puerh and Cheli and another to Tsuhsiung and Tali ; from Tali, one line to Siching, Yungchang and Tengchung and another to Likiang and Patang. The two branches in Yunnan are primarily for frontier defence.

3. Nanking-Thibet Line—From Nanking to Lhasa *via* Pukow, Luchow, Luan, Kushih Kwangchow, Loshan, Sinyang, Tunpeh, Tsaoyang, Fancheng, Laohokow, Yunyang, Paiho, Hingan, Hanchung, Tungchow, Chengtu, Yachow, Tachienlu, Litang, Chamuto and Locheng. This line follows the route of the formerly projected Pukow-Sinyangchow Railway, which is not on the present railway construction program of the government.

4. Fukien-Sinkiang Line—Foochow to Ili *via* Yenping, Shaowu, Kwangtseh, Nancheng, Fuchow, Nanchang, Ani, Changkungtu, Paicha, Yangsing, Ocheng, Wuchang, Hankow, Siangyang, Laohokow, Yunyang, Sian, Lanchow, Chiayukwah, Anchang, Singsungchia, Hamicheng, Sichitai, Tihwa, Silai and Wusu.

There are two important reasons for the selection of this line, first, to connect the northwestern with the southeastern provinces, and secondly to develop the great northwest. The western end of the line is mainly for the purpose of national defence. From Nanchang to Foochow, it coincides with the projected Foochow-Nanchang Railway.

5. Nanking-Mongolia Line—Nanking to Maimaichen *via* Pukow, Fenyang, Yingchow Chouchiakow, Chengchow, Chinghua, Tsehchow, Taiyuan, Tatung, Pingtichuan, Pangkiang, Ude, Taoling and Urga ; with Branch from Fenyang to Linghuaikwan. This line is to afford Shansi and Mongolia convenient access to the capital and also to facilitate national defence on the northern frontier.

6. Nanking-Heilungkiang Line—From Pukow to Heiho *via* Luho, Huaiying, Haichow, Chichow, Weihsien, Wuting, Tsangchow, Tientsin, Peping, Chengte, Chifeng, Kailu, Taonan, Lungkiang, Nengkiang and Aihun.

The line is based on the projected provincial highways of Kiangsu, Shantung and Hopei. The northern section from Jehol and Heilungkiang to the Border is also the route of a projected railway, of which the Taonan-Angangchi section is already in existence.

7. Kalgan-Suiyuan Line—From Kalgan, Chahar to Suiyuan. Kirin *via* Chifeng, Chaoyang, Singlitun, Singming, Mukden, Hailung, Kirin, Wuchang, Fangcheng, Ilan and Lingkiang.

8. Kansu-Thibet-Sinkiang Line—From Sining, Kansu to Hotien, Sinkiang *via* Yienchih, Yushutussu, Lhasa, Tsashihlunpu, Niehkamu, Chiatoke and Lotoke.

9. Suiyuan-Sinkiang Line—From Paotou, Chahar to Sula, Sinkiang *via* Wuyuan, Ninghsia, Langjow, Sining, Tanhuang, Jotsiang, Chiemo, Yutien and Hotien.

10. Heilungkiang-Mongolia Line—Manchouli to Wusu *via* Urga, Uliassutai, Kobdo, Chenhuassu and Tacheng.

11. Tihwa-Sula Line—Tihwa to Sula *via* Tulufan, Ichi, Kuchu, Paicheng, Wensu, Wushih and Pachu.

12. Shensi-Kwangsi Line—From Tungkwan to Wuchow *via* Sian, Paochi, Hanchung, Tungchuan, Chengtu, Luchow, Tsunyi, Kweiyang, Tuyun, Chingyuan and Liuchow.

The Construction Program

In the proposed construction program, the projected lines were divided into four groups as follows :

GROUP 1—Nanking-Kwangsi Line
Nanking-Tali Section, Nanking-Yunnan-Sikang Line
Yunyang-Chengtu Section, Nanking-Thibet Line
Wuchang-Lanchow Section, Sukien-Sinkiang Line
Paotou-Sining Section, Suiyuan-Sinkiang Line

GROUP 2—Tali-Tenchung Section, Nanking-Yunnan-Sikang Line
Luchow-Siangyang and Shasi-Chengtu Sections, Nanking-Thibet Line
Foochow-Wuchang and Lanchow-Tihwa Sections, Fukien-Sinkiang Line
Nanking-Mongolia Line and Pangkiang-Kalgan Branch
Shensi-Kwangsi Line

GROUP 3—Tali-Patang and Kunming-Cheli Sections, Nanking-Yunnan-Sikang Line
Chengtu-Lhasa Section, Nanking-Thibet Line
Tihwa-Ili Section, Fukien-Sinkiang Line
Kalgan-Suiyuan Line

GROUP 4—Kansu-Thibet-Sinkiang Line
Sining-Sula Section, Suiyuan-Sinkiang Line
Heilungkiang-Mongolia-Sinkiang Line
Tihwa-Sula Line

The Lines in the first two groups constitute the China Proper Lines, while the remainder, the Frontier Defence Lines. As the establishment of communication is all important, it is proposed that earth roads are to be built first to be turned into macadamized roads afterwards. Macadamizing is to be done as soon as funds are available, since, as we all know, earth roads are rather expensive in the cost of maintenance. While the completion of the whole system of national highways requires hundreds of millions of dollars. It is gratifying to know from the preliminary estimates made at the conference that the China Proper Lines can be completed with earth roads for approximately seventy million dollars. Thanks to the recent highway construction movement initiated in the different provinces, a substantial portion of the China Proper Lines has already been opened to traffic.

The Sunglung Flood Protection Project

The article in our June issue on this interesting project, which was taken from Publication No. 18, of the Board of Conservancy Works of Kwangtung Province, of which Mr. Olivecrona is the Engineer-in-chief. The above facts were inadvertently omitted.

Railway Economics for China

By H. Stringer

THE Nationalist Government having embarked on a program of reconstruction, in which improvement of communications takes perhaps the most important place, it is of the utmost importance that the initial steps taken to this end shall be in the right direction.

In the first place, there must be no dispersal of effort. There have been indications of a recurrence of the disease of provincialism in railway projects which the past has shown to be so expensive. The policy of centralized control of railway policy initiated in 1911 was unquestionably a wise one and nothing should be done to reverse it. The enthusiasm for aircraft, in the present state of China's foreign credit, must be classed as entirely false. It is a toyshop need to be sternly suppressed as of little commercial value. China must confine herself rigidly to essentials, the completion of the Canton-Hankow and the Hankow-Szechuen Railways are the first of these. Then she must revive from their derelict and unproductive state those railway projects on which money has already been spent. These are as below :—

	Approximate Expenditure
Hankow-Szechuen	£1,000,000
Pukow-Sinyang	207,000
Nanking-Hunan	200,000
Ching-Yu Railway	1,085,000
Pin Hui	100,000
Peking-Suiyang Extension...	800,000
	£3,392,000

At the present time the study of economy is of paramount importance. This being so the study of the science of railway location should receive far more attention than has been given to it in the past. There has been too great a tendency in the past to cling to the vicinity of the old highways. This is of small importance in easy country, but in country of any difficulty it may lead to most costly mistakes. The Peking-Kalgan Railway is a case in point. Generations of engineers will bewail those costly 1 in 30 gradients, which have added an enormous yearly tax on operating costs with no compensating advantage of possibility of drastic deviation without huge capital expenditure. To quote a Chinese proverb which is applicable to life and railway location : " The error of one moment becomes the sorrow of a lifetime."

Then economy can be effected by adopting new standards of railway construction, but this is a policy which should be carefully considered in the light of experience of local conditions.

After obtaining the best possible route for a railway the factors governing carrying capacity are in order of importance (1) gauge, (2) railway weight and road bed.

Saving in construction costs could be effected by the adoption of a narrower gauge, say metre or 3-ft. 6-in, but this would be extremely unwise.

In the first place China should, after the completion of the two trunk lines mentioned above, concentrate her energies on the provision of an adequate railway system for that portion of the country where construction would be cheapest, population is greatest, and profits adequate and rapidly earned. This district is known as the Great Plain of China which covers an area of 210,000 square miles and has an estimated population of 625 persons to the square mile—the densest in the world. The Plain is bounded by a line which runs from Shasi to Peking in the west, its eastern boundary being the sea. In all this area good location should give curves of 1,000 feet radius and gradients not exceeding 1 in 120, and earthwork should not be a heavy item. This implies that one of the main savings to be expected from the adoption of narrow gauge is at once eliminated. In fact it is calculated that the saving from the adoption of 3-ft. 6-in. gauge in this area would not exceed 7 per cent. on the capital cost of 4-ft. 8½-in. gauge. Even though the narrow gauge line would have, with similar rail weight, almost the same capacity as the standard gauge, the certainty of congestion at transhipment points should rule out the paltry saving effected. The experience of the world is against the adoption of mixed gauges, and it has been found in India that the working expenses of metre gauge are 25 per cent. more than the 5-ft. 6-in. gauge. Even in heavy country where gradients as high as 1 in 40 and 300 foot curves might have to be adopted, and where the case for narrow gauge was probably a strong one, the advent of the motor tractor has altered the situation entirely and it is now questionable whether such areas would not be best served by good motor roads unless there are great mineral possibilities. With the exception of one short railway, China is so far committed to standard gauge and she should not abandon it.

The economy to be effected from the adoption of a lighter rail is not so certainly disposed of. China has no steel industry which can be called her own. Her steel industry, which is quite inadequate for her railway needs, is in Japanese hands and Japan can absorb all the output. Until China elects to produce the cheapest steel in the World, economy in this material is a vital consideration as at least 30 per cent. of the cost of railways is for materials of which steel is the basis, the principal item being the rails whose weight largely controls the capacity of the line. The case for the 60 lb. rail as against the 85 lb. rail can be stated as follows :—

Difference in cost per mile of road bed :—

85 lb. rail		60 lb. rail	
156 tons steel at £10 ($120) ...	$18,720	112 tons steel at £10 ($120) ...	$13,440
900 fang ballast (8-in. under)	4,050	700 fang ballast (6-in. under)	3,150
50 miles carriage on ballast		$2,50 (4/2d) in trucks at quarry.	
2,488 sleepers (14-ft. to 30-ft. rail) $2.50 (4/2d each	6,220	2,112 sleepers (12-ft. to 30-ft. rail)	5,280
Total cost per mile ...	$28,990 (£2,420)		$21,870 (£1,827)

Now the maximum capacity of a single line of railway in the District of the Great Plain is, for a railway equipped with a 60 lb. rail and stations at five mile intervals, about 4,300* tons daily or 1,680,000 tons yearly. This is the capacity for a length of line dependent on the average haul which averaged 184 kilometres or 115 miles for the whole Government system in 1918. In this year the Railways carried 632,040 tons over a length of line equal to this average haul, indicating that the 60 lb. rail would be adequate for initial needs for many years as the mileage concerned had been in operation for an average of about 15 years at this date.

The saving stated above does not represent the total saving by any means, for the economy in the cost of steel work in bridging would be a very considerable item even if the larger bridges, where replacement would be difficult under traffic, were built for the 85 lb. rail. Further, when the heavier rail became necessary, the 60 lb. rail together with the bridges for this weight of rail could be reused for feeder lines.

It will be seen that the cost of stone ballast amounts to 7 per cent. of the total cost of the road bed, and economy might be effected in using sand or gravel, or selected material from borrow pits, as has been done in tropical Africa and South America. This would, however, be a doubtful experiment in a country where even the initial train density is high. Further, though the rainfall is not so torrential or continuous here as in tropical Africa, train density in that country, where this policy has been a success, would not exceed at most two per day.

*The figures for capacity are derived in the following way and rest on the assumption that grades in this district would not exceed one in 120, a very reasonable hypothesis. On this basis and with stations as above a maximum of 32 goods trains out of a possible 36 is assumed, the remainder being passenger trains. Each goods train would consist of about 62 axles with a car capacity of 370 tons of which only 37 per cent.—a distinctly low figure—is taken as paying load. This gives a daily tonnage over a length of line depending on average haul of 4,300 tons as above.

The sleeper question also needs serious consideration. At present the Jarrah sleeper with a proved life of about 25 years in the Shanghai district is undoubtedly the best investment for China. The initial cost is undoubtedly high, but with an uncertain political future only the best materials should be used in the construction of the most vital portion of the railway organism. The day of the steel sleeper will not come until China has reorganized her steel industry, or until there is a further rise in the price of this class of timber sleeper.

The question of feeder lines to the existing system should also receive immediate attention as under 8 per cent. of the existing mileage now falls into this class indicating that there is a large undeveloped field for expansion. How large this field is can be judged when it is seen that no railway in the country has yet reached maximum capacity for single line traffic. Much also might be done in this direction until China can afford to spend money on such railway development by the construction of a road system to feed the existing railways. It is estimated that adequately metalled roads could be constructed in the District of the Great Plain where there would be long haulage on stone at a cost not exceeding $13,000 per mile, whereas a railway equipped with a 60 lb. rail would cost not less than $90,000 per mile. In adopting such a road policy China would only be following generally accepted practice elsewhere. She would also provide opportunities for her surplus labor and create an increased demand for entirely local materials.

The adequate provision of rolling stock also needs careful scientific consideration. The question of what is adequate or inadequate in this respect is a thorny one, but it appears that it should be considered from the following point of view. Thus take the case of a line equipped with 60 lb. rail, single track with crossing stations at five mile intervals and with a limiting grade of one in 120. Goods trains on such a line would not exceed a car capacity of 400 tons and if we assume that freight is 50 per cent. of capacity hauled, tons of freight per train should be 200. Then if the average haul is 100 miles, each 100 miles of line should be equipped with a car capacity of 400, multiplied by the number of necessary trains obtained by dividing the daily tonnage available by 200 tons. This number of trains is, of course, limited by line capacity which is, say, 32 goods trains out of a daily total of 36—four being passenger trains—for a single line as above. Thus the maximum daily capacity of a single as above is about 6,000 tons per 100 miles and for this 12,000 tons of car capacity is required or four 4/30 tons cars per mile. Passenger stock can be treated on the same basis with an assumed relation between seat mileage hauled and seats occupied, generally about 25 per cent. The above, of course, assumes a daily motion of 100 miles per car and neglects stock not in motion. This might be true for passenger stock only on double track lines, but for goods stock is incorrect for single track lines at least, and probably double track. Thus in the U.S.A. daily movement per wagon is 28.1 miles with a 30 ton load while in Japan it is 58 miles, and in England about 15 miles and one ton. Figures for goods stock should thus be increased.

Of minor constructional economies the most important one is the elimination of the high level platform and the provision of planking platforms between track at stations. This leaves station layout on that more flexible basis which is a necessity for railways in new country.

The provision of a lighter rail is the one economy which would seem to be entirely sound policy.

The New Japanese Cabinet

(Continued from page 291).

anti-foreign movement developed in China, including the Japanese as well as the British. It required great tact and an understanding of the Sino-Japanese situation to prevent this movement from involving Japan in an open and prolonged conflict with China, particularly as Japan's special interests in Manchuria made occasional direct interference in Chinese affairs, whenever the peace of Manchuria was endangered, necessary and inevitable. Throughout this period Baron Shidehara proved himself to be not only a great statesman but a friend of China.

His present colleague, the Minister of Finance, Mr. Junnosuke Inouye, has always been regarded as the eventual successor to Viscount Shibusawa, as the Financial leader of Japan. He is an ex-Governor of the Bank of Japan, but undoubtedly his greatest service was the up-building of the Yokohama Specie Bank, of which he was vice-President from 1911 to 1913 and the President to 1919. In a word, he directed the affairs of this wonderful institution during the entire War period, when Japan reached an amazing prosperity.

Mr. Inouye has also played a signal part in the development of friendship between the United States and Japan. After the Versailles Conference, there was a determination on the part of Americans that the spheres of influence which forced American banks out of China, should come to an end, that instead of cut-throat international competition, there should be international co-operation in financing the reconstruction of China. The only two countries which had enough money to do the job, at that time, were the United States and Japan. If they co-operated, they would have to carry their partners; if they chose to compete, each could do the job alone. There was a feeling in most countries, that Japan would refuse to join the Consortium. Japan made certain reservations, which were wholly misunderstood but with regard to which, Mr. Lamont said :—

> It has sometimes been alleged that the insistence of Japan on the reservations regarding Manchuria and Mongolia is due to her policy of aggression and that she has thereby delayed the formation of the Consortium. That is a conjecture entirely devoid of foundation. The demand for the insuring of the right of self-preservation, with a view fundamentally to the requirements of national defense and of the economic existence of the nation, represents a serious national sentiment, and should by no means be regarded as emanating from the political ambition of a small section of the people.

It was Mr. Inouye who made the successful organization of the Consortium possible. As soon as he agreed that Japan would join this body, Mr. Thomas W. Lamont, its Chairman, visited Japan and China. To Mr. Inouye must go the credit of bringing Japan into harmony with America's financial program in China upon which depended to such a large extent the peace of the Pacific.

It is a remarkable fact that at this moment the two Cabinet officers who will have so much to do with American-Japanese relations (which are increasingly financial as the United States invests increasingly large amounts in Japanese enterprises) should have laid the foundation upon which this mighty structure of friendship has been erected.—G.E.S.

Correspondence

[*In the May issue of the "Far Eastern Review," we published the report of the Commission appointed to investigate the Shanghai-Nanking Railway. Mr. A. C. Clear, formerly General Manager and Engineer-in-Chief of the Railway, who resigned since the report was made, has sent us the following letter :*]

Shanghai, June 20, 1929.

My Dear Sir,

I thank you for calling my attention to the Article in your May 1929 issue on the Shanghai-Nanking Railway.

There has been no public statement of this case by the individuals concerned as it was not contemplated that the findings of the Commission would be taken at more than their face value.

When, however, a journal of such high repute as yours gives publicity to this document it is necessary to reply.

At the outset the personnel of the Commission was protested against by the British and Chinese Corporation, whose claim to be represented was ignored, although the Railway is defined in its Loan Agreement as "the joint enterprise of the Chinese Government and of the British and Chinese Corporation." Neither was the principal executive officer of the Railway, *i.e.* the General Manager, called upon to give evidence. No attempt was made to find out the difficulties experienced through lack of Capital Funds, ignoring that for the past nine years continuous effort had been made to obtain money for essential needs.

No allowance was made for the numerous evils and damage attendant upon military occupancy of the railway, throughout which the staff was continuously subjected to various forms of intimidation and physical danger. In fact the report is prejudiced and deliberately misleading. Much of it is founded on ignorance

of the adverse conditions brought about by these Civil Wars, and by ignoring a great deal of recorded information on essential improvements which have been recommended.

After fifteen-and-a-half years of administration under as many different Chinese Administrations, in all of which, in spite of inevitable difficulties arising out of Loan Agreement conditions, mutual respect and friendliness have prevailed, this present Commission can sound no single note of appreciation.

In view of the Railway's recorded progress during this long period, even under adverse conditions, the Commission stands self-condemned.

Under such circumstances I do not propose to waste time on a detailed reply to the numerous charges made, but will give you the facts of one or two of the grosser allegations.

To quote from your Article :—

> "The Weighbridge though available for taking coal deliveries was not used at all. Instead, a slow and inefficient method of taking coal deliveries by means of baskets was used. That led to a great deal of leakage."

Every semi-annual stock taking of coal records a surplus, and although the coal contractor was advised that his method of accepting weight by basket meant a direct loss to him of about 2.26 per cent. he preferred his own weighments to wagon weighments in bulk over the weighbridge. Every weighment is duly checked by railway employees. All coal is of necessity handled in baskets, therefore the additional time taken up on the weighbridge retards delivery. Apart from this the receipt of coal at Woosung is of a temporary nature brought about by the closing down of the Tientsin-Pukow Railway over which our coal has been carried for many years and received at Nanking Ferry.

To quote again :—

> "The General Manager even went so far as to ratify an unauthorized and illegal transaction of nearly $200,000 by the late Chief Storekeeper, Mr. Cook."

Mr. Cook was irregularly engaged some ten years ago as Chief Storekeeper of the Shanghai-Hangchow-Ningpo Railway by the Chinese Managing Director—I had no authority in any department of the Shanghai-Hangchow-Ningpo Railway except that of engineering.

Later, after considerable difficulty and protest Mr. Cook was made Chief Storekeeper of both railways.

In due course Mr. Cook obtained home leave and Mr. Tappenden acted in his stead. It was then discovered that Cook had, without authority, placed large orders for stores on the S.-H.-N.R. and upon this being reported to the Managing Director he was summarily dismissed.

Subsequently it was found that certain orders on the Shanghai-Nanking Railway also had not been properly authorized, but as the stores were required and the man had already been dismissed, no further action could reasonably be taken.

> "The reluctance of the General Manager to deal with the Hongkong & Shanghai Bank for loss sustained in connection with a stolen and forged cheque."

This was a matter in which the Managing Director, Chief Accountant and the Bank were involved. I was merely asked by the Managing Director to intervene in the rôle of friendly arbitrator and succeeded in arranging a settlement which was acceptable to both parties and thus avoided an expensive lawsuit.

With regard to personal charges, I have been meticulously careful that all rules should apply equally to myself as to others; whilst I have not by any means received the full benefits due to me after my twenty-five-and-a-half years' service.

As you are aware, the Loan Agreement of the Shanghai-Nanking Railway provides safeguards to the Bondholders through the control exercised by its Board of Commissioners consisting of three British and two Chinese members.

The functions of the Board were considerably modified in 1908 by the appointment of a Chinese Managing Director to exercise its authority, and of a General Manager responsible for the technical working of the railway.

This latter official being also a member of the Board of Commissioners it was part of his duties to draw attention to any breaches or departures from the terms of the Loan Agreement or infringement of the authority of the Board.

Such irregularities principally arose out of circular instructions to all railways issued from time to time by the Ministry of Communications (now Ministry of Railways) which, although possibly incompatible with the terms of the Loan Agreement, were invariably passed on by the Managing Director for the General Manager to fulfil, the opprobrium of criticizing thus resting upon the General Manager. The fact that special letters of Agreement were signed giving the Railway Administration the right to criticize such circular instructions when necessary did not reduce the odium attaching to the General Manager's position. Under such circumstances it will be understood that the General Manager throughout has had to maintain a difficult position, often subject to adverse criticism, but has in the past succeeded in vindicating each action as being beneficial to the Chinese Government and railway interests. However, with the present administration came a new spirit, constant impositions were made which were contrary to Loan Agreement conditions and these were followed by a violent attack on the position of General Manager.

The culminating point was reached when I protested against the demand of one month's pay from British and Chinese staff for famine relief which followed immediately upon the granting of a half-month's pay as a relief from the high cost of living. Although voluntary contributions were offered by the railway staff the Ministerial officials insisted upon the carrying out of an instruction which violated all security of service.

Consequent upon this my resignation was demanded and acceded to by the Corporation after consultation with me. Conditions were intolerable and I was no longer in a position to carry out my duties or afford protection to the staff.

After my resignation a Nationalist Mandate, originally issued in 1926, was publicly reiterated forbidding Chinese Government employees to be forced to contribute to charitable purposes as they might be tempted to make good from irregular sources.

As an illuminating sidelight on this incident, I read in this morning's "North-China Daily News" that instructions have been issued from the Ministry of Railways that all sums deducted from the pay of employees for famine relief are to be refunded.

The Commission attacks in minor notes, the Traffic Manager, Mr. C. L. G. Wayne, an exceptionally able railway man who held a high position on one of the leading English railways and was especially persuaded to come to China because of his marked ability and integrity. His service with the Chinese Government is full of well deserved commendation and he has ably filled many important positions on Traffic Conferences and has laid the foundations for future traffic working on all China's railways on sound lines. During the recent years of continuous military action on the Railways he has gravely menaced his health by his unfailing and unfaltering service, often at considerable personal risk. His devotion to duty has been exceptional and in any other service he would have been accorded high honours, instead of which he receives curt notice of the termination of his Agreement and has already left the country.

I refrain from commenting on the injustice of Mr. Tappenden's case which so far remains unsettled.

I am,

My dear Sir,

Yours very truly,

A. C. CLEAR, M.INST.C.E.,
Late Engineer-in-Chief and General Manager S.-N. R.
Engineer-in-Chief S.-H.-N.R.

The Editor,
"Far Eastern Review,"
Shanghai.

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29 Canton Road.
Shanghai, June 28, 1929.

DEAR SIR,

"Bean Milling in Manchuria"

We have read with interest the series of articles on the above subject which have appeared in the "Review" from time to time but we feel that for the sake of accuracy, we must point out one or two inaccuracies which appear in the article in the June issue.

As our authority for making the above statement, we would point out that Oil Milling Machinery is our principal speciality, our firm having been established now 152 years and engaged in the manufacture of machinery for the recovery of vegetable oils

of all kinds for more than a century, and as a matter of fact we supplied the first steam driven oil mill in China, when we erected a mill at Newchwang in the year 1868 for the treatment of soya beans, and as a contrast to that mill, the largest and most modern mill in Manchuria, *viz.* the Anglo-Chinese Eastern Trading Co., Ltd., or Kabalkin Mill, at Harbin, is equipped with machinery manufactured and supplied by us.

In your June issue you make mention of the Solvent Extraction Process giving figures which might be very misleading, and as there iz a certain amount of interest in this process in Manchuria your figures might be a deterrent to prospective users of this process.

On page 274 you mention that the meal residue from solvent extraction contains 2.5 per cent. or so of oil and your table VI. shows that only 14 per cent. of oil can be extracted from soya beans, and you also show a loss of 6 per cent. on working by the solvent extraction process.

With our latest process we are able to guarantee that the meal will contain no more than 1 per cent. of oil, and we enclose a section from our catalogue "Oil Extraction by Solvents" in which it is stated that meal could contain as little as ½ per cent, this being decided by the economics of the concern though if necessary the meal could be completely free from oil. It should however be pointed out that this 1 per cent. oil in the meal is not 1 per cent. of the original raw material, since the bulk of the oil has been taken from the original weight of raw material, thus the oil in the residue is considerably less than 1 per cent. of the original weight of beans treated.

It would appear from your article that by the Solvent Extraction Process only 14 per cent. of oil can be taken from soya beans. The amount of oil which can be extracted from any oil bearing material depends upon the amount of oil which it contains. Soya beans contain anything up to 19 per cent. of oil according to the quality of the crop, some seasons yielding a better crop than others, but instead of only 14 per cent. of oil yielded as per your table, with the solvent extraction process all the oil can be obtained if necessary, though it is calculated that by leaving say 1 per cent. of oil in the finished meal, that is 1 per cent. of the weight of the finished meal, the plant would be worked economically, so that if the beans contained 18 per cent. or 19 per cent. of oil, practically all of this could be secured.

You lay down as a hard and fast rule that by the extraction process there is a loss of 6 per cent. and compare this with the old low pressure hydraulic process which you show to give a gain of 4.8 per cent.

In the extraction process there need by no loss whatsoever, for the loss you show is merely the difference in the moisture between that in the original beans and the finished meal. In the beans there may be say an average moisture content of 13 per cent. and if when finishing the meal after extraction 13 per cent. is left in then there would be no loss of weight, but it should be pointed out that if the meal is required for export it may be somewhat dangerous to export a meal containing 13 per cent. of moisture since this might mildew in transit, and for this reason the meal is dried to a figure of moisture content which will travel safely, but we might point out that your figure of 4.8 per cent. gain with the old round cake hydraulic process is merely a fictitious gain, this representing added water, and to a certain extent it is this adding of superfluous water which has brought the mills using the old round cake hydraulic process into difficulties, and the process if worked properly would not show a gain, indeed as compared with the modern hydraulic or extraction process, these mills are most uneconomical

Buyers of cake or meal do not wish to pay for water and it is for that reason the meal from an extraction plant or a modern hydraulic plant fetches a higher price than either the old round Manchurian cake or meal from those cakes.

To illustrate that we are conversant with the solvent extraction process we might mention that the illustrations in our catalogue section are from photographs of the largest solvent extraction plant in the World, this plant being capable of treating 1,500 long tons of soya beans per working week of 132 hours and being only one of very many solvent extraction plants which we have manufactured and supplied to various parts of the World.

Yours truly,

ROSE, DOWNS & THOMPSON (Far East), LTD.

Y. C. HINDSON, *Manager*.

Book Notes

THE CHINESE REVOLUTION, 1926-1927, by H. Owen Chapman London, Constable & Co., Ltd., 1928.

Dr. Chapman's "The Chinese Revolution 1926-27" is a serious effort to trace the forces which were responsible for the march of the Kuomintang from Canton to the Yangtze. The introductory Chapter I is rather weak and does not convey an ability to handle historically, impersonally and accurately the facts of a China which Dr. Chapman apparently did not know. But the remainder of the volume is, on the whole, a splendid presentation of a complex situation, written with more understanding and with less propagandistic zeal than any other book on this subject which I have yet seen.

The Hankow days are particularly well analyzed; the rôle of Borodin and the Communist Party of China are presented in adequate perspective. The emancipation of women, undoubtedly the outstanding benefit to China from this revolution, is for the first time portrayed with surgical punctilliousness.

It is the emancipation of woman in China which affords the fascinating achievement of the Communist revolution. It is probably true that such a movement was accompanied by sexual extravagance, that as the old order broke down, the restraining force of the family system was weakened and individual inhibitions were inadequate to provide a moral equivalent, but the new womanhood of China is a startling fact.

Free, independent, upright, alert, the new woman is nurturing a new race. What a contrast with the lily-footed gentlewoman of the past decade is the poiseful young girl, dancing, playing tennis, vigorous and full-souled! No trifling resolutions produced these characteristics. They are the spirit of a new era released in motherhood.

Dr. Chapman occasionally permits himself a modicum of prejudice, which is so unfortunate in an otherwise accurate document. For instance, on page 210, he places the blame for the failure of the Kuo Sung-lin revolt to Japan's defensive measures in the Railway zone. The facts of the Kuo Sung-lin rebellion were perhaps shrouded in northern dust when Dr. Chapman prepared his manuscript but they are now sufficiently well-known to make correction possible. Kuo Sung-lin depended upon Feng Yu-hsiang to provide reinforcement and Feng Yu-hsiang was slow in coming. Had Feng Yu-hsiang arrived in time, it is quite possible that the Kuo Sung-lin revolt might have succeeded and that the Communist revolution might have started in Tientsin rather than in Canton. General Feng's fabian tactics have time and again proved costly to his allies: for instance, in the recent Wuhan fighting, he was late, so that when the troops finally came to Wushengkwan, the war was over and General Chiang Kai-shek was in possession of Hankow.

On page 236, Dr. Chapman gives an account of the breach between Hankow and Moscow and here he gives General Feng Yu-hsiang the full credit for the achievement. This is a wholly incorrect version. He omits the discovery by Sun Fo and others of the secret instructions from the Third International to Borodin. These episodes are fully described in my chapter on the Kuomintang in the 1928 China Year Book and the data was given to me by participants in the incidents.

The most cogent significance of Dr. Chapman's volume is the fact that it places the Communist relationship to the events in China in 1926-27 exactly. By careful arrangement of his material, by the conservative iteration of exact facts, he narrates what happened without the fallacious opinions based upon propaganda.

G.E.S.

THE DESIGN, CONSTRUCTION AND MAINTENANCE OF DOCKS, WHARVES AND PIERS, By F. M. Du-Plat-Taylor, with an Introduction by Sir Joseph Broodbank. Messrs. Ernest Benn Limited, London, 1928.

This is a valuable compendium of information of Docks, Wharves and Piers, showing the arrangement from most ancient times to the present. The volume is fully illustrated by diagrams, drawings and photographs, there being altogether more than 450 illustrations. All modern appliances are fully described. This book is particularly useful to Chinese engineers interested in this problem as it presents to them all the experience of all countries and all engineers from primitive times to the present.

Ruston No. 4, Universal Excavator

We have received from Ruston & Hornsby, Ltd., an interesting illustrated catalogue describing Ruston No. 4. Universal Excavator. This catalogue shows the multifarious activities of this machine and also contains sketches and drawings describing its equipment in detail. Engineers interested in excavations, draining, dredging, etc, should write to Ruston & Hornsby, Ltd., Lincoln, England, for a free copy of this useful publication.

A Short History of China by Edward Thomas Williams, New York. Harper & Brothers.

Dr. E. T. Williams has had a long personal experience with China and is easily competent to write its history. The present volume is invaluable to one who seeks facts. It is not an imaginative work; there is no florid literary style to carry the reader along: there are only the historical facts, stated accurately and boldly. Dr. William's book is an excellent reference work to which the reader may always refer for his background to current events.—G. E. S.

Excavating Machinery as presented by Power Shovels, Drag Lines and Grabbing Cranes. By W. Barnes, M.I.MECH.E. Messrs. Ernest Benn Limited, London, 1928.

This is a very interesting volume dealing with the Power Shovel and again goes back to origins and passes through all the developments of the Power Shovel to the present marvelous machinery which seems to be capable of moving mountains. Engineers interested in the substitution of mechanical for hand labor will find this book invaluable not only because of its explanation of the development of this form of machinery, but more because it details the various types of excavating machinery, giving impartially the due credit to all types and therefore making it possible for the engineer to choose each specific machine which he requires for his job.

America's International Relations

Survey of American Foreign Relations, 1928, by Charles P. Howland, Director of Research, of the Council of Foreign Relations, Published by the Council of Foreign Relations, New Haven, Yale University Press, 1928.

This extremely useful summary of America's international relations differs from similar year books in that it is not a summary of events during a single year but rather deals with the subjects of the most salient interest at the time, bringing them up-to-date from their beginnings with historical and scholarly completeness.

It was only to have been expected that the first of these issues should devote a very large section to the origins and traditions of American foreign policy. This is a subject which is only just beginning to be understood by the rest of the world, after the severe shock of the failure of the United States to ratify the Covenant of the League of Nations which came into existence upon the insistence of the President of the United States, Mr. Woodrow Wilson. The relationship between the President of the United States and the Senate of the United States in the conduct of international relations is unique and at the present time, exceedingly troublesome, for it is never certain whether an agreement entered into between the United States and any other country can survive senatorial interference and revision.

When the United States revolted against Great Britain and established a new nation, only isolation in international relations afforded a guarantee for success. It is altogether correct that France assisted the 13 colonies to revolt and to become independent but the fact remains that had the United States formed an alliance with France, the new nation would soon have become involved in the Napoleonic politics of Europe and would easily have become subject to the obligations as well as the benefits of alliances. Washington definitely turned the face of the American people from such alliances, yet the kin relationship with Great Britain, the call of race, as it were, has permeated American international thinking even to this day. The policy of isolation saved the energy of resources of the United States for the American continent during the turmoil and military madness of Europe during the first half of the nineteenth century. In fact, this political conception went even further and divided the world into two spheres, the European and the American, over the latter of which, the Monroe Doctrine served as a guiding principle. "The vital question," as Professor Latané says, "not not our duty to the rest of the world but whether the rest of the world would let us live." The consequences of a policy of isolation from the very beginning, may easily be imagined. The political thinking of the American people became singularly insular, so that when they were faced with the necessity for participating in European affairs a readjustment was required which involved more time and consideration than Mr. Wilson was prepared to allow. Mr. Howland discusses brilliantly this period of readjustment and transformation in his chapters dealing with the League of Nations.

The powers of the President of the United States appear to be almost dictatorial to non-Americans, but actually, the Constitution provides for checks and balances, which at crucial moments, makes the President subservient if not responsible to Congress.

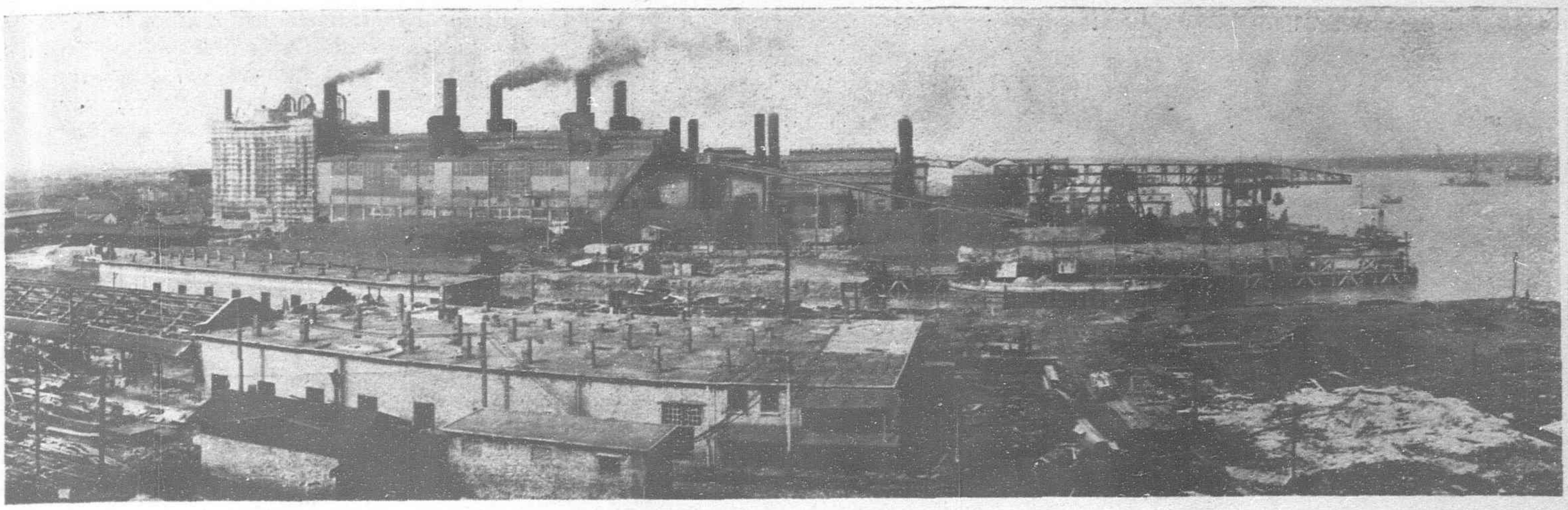
"The President can in ordinary times do a great deal without giving Congress an opportunity to act, and in times of emergency Congress usually finds itself obliged to support the policies he has begun. Thus the President can initiate and negotiate all treaties through agents and instructions unknown to the Senate or Congress. He can make executive agreements on all matters within his independent power of enforcement without consulting the Senate at all. He can utilize the forces to repel invasion, enforce treaties and protect citizens abroad, thus practically committing the country to war. He is the representative authority of the United States, alone competent to correspond officially with foreign governments. He nominates and commissions ambassadors, ministers, and consuls, though he must get Senate consent to their appointment, and receives foreign ambassadors and ministers; he has thus the sole power to recognize foreign governments and states. The Presidents have also assumed power to recognize the existence of neutrality, or of peace upon the termination of war, though in the case of the termination of war with the Central Powers, President Harding followed the congressional resolution of July 2, 1921. Executive declarations and precedents have been the main factors in building up permanent foreign policies."

In spite of these vast powers, the advice and consent of the Senate is necessary in international relations, because the power to ratify a treaty rests with the Senate. Furthermore, the appropriation of funds to make provisions of a treaty effective rests with both houses of Congress, appropriation bills originating in the lower house. The President then is faced with the dilemma of risking the defeat of treaties which he negotiates or consulting with the members of the committees in charge of foreign relations of both houses. Such consultations are at times difficult during the period of megotiations, particularly if there is a necessity for secrecy. When the Chairmen of Committees are of the same political parties, the task of the President is somewhat simplified, as it is at present for President Hoover, in his relations with Senator Borah, but Mr. Wilson was undoubtedly driven to a premature grave by his inability to achieve such co-operation. Numerous suggestions have been made to solve this problem. These will be found in the volume under review.

It is impossible, in the space allotted to this review, even to consider the very able discussion of the chapters dealing with debts and reparations. And no review could adequately reward the reader, for the facts themselves are all that one wants and the facts must be found in Mr. Howland's study. It is important, however, here to note that the misunderstandings which have arisen over these subjects are due principally to ignorance as to the facts and the student would do well to place the present volume at his elbow when he seeks to discuss highly intricate problems arising out of approximately 80 billion dollars of war expenses.

Curiously, the Far East consumes very little space in this summary of American international relations. We are told that the United States is facing towards the Far East as a potential market, but the American people, after all, deal with realities and not potentialities and American relations with Europe and South America still consume the major thinking of the American officials and people. The principal co-operative effort of the United States in the Far East has been the International Banking Consortium, which the Chinese have resisted for ten years with the result that although the United States is a creditor on a grandiose scale in Europe and South America, her interests in China are too small to be notable.

Mr. H. B. Elliston, who will be remembered by far Eastern readers, as a resident of Shanghai and Peking, assisted in the preparation of the material for this book.—G.E.S.



Panoramic View of Riverside Power Station.

Complete Description of the Shanghai Municipal Electricity Plant

A PUBLIC utility which has been controlled and operated by the Shanghai Municipal Council since 1901 is expected to pass into the hands of private capital when the American & Foreign Power Company, Inc. of New York City, will have completed their purchase of the Electricity Department for the sum of Taels 81,000,000.

The documents are to be signed by Mr. S. M. Edwards, secretary of the Municipal Council, and Mr. S. W. Murphy, counsel for the American & Foreign Power Company, Inc.

The bids of three groups were opened March 19 and it was found that the offer of the American & Foreign Company, Inc., exceeded by Taels 30,000,000 that of their nearest competitor. The Ratepayers of the International Settlement approved the sale of the department to the above corporation April 17 in their annual meeting.

Resident engineers of the American & Foreign Power Company, Inc., collaborating with engineers from the Electricity Department have prepared a detailed prospectus of the Plant, which has been sent to the home office in New York City. This article was written from that report and represents the first complete description of the department to be published.

System Arrangement

ELECTRIC POWER SUPPLY—GENERATION.—All power is generated at 6,600 volts, 3 phase, 50 cycle at Riverside Power House, a steam plant located near the eastern end of the Settlement and having a present installed capacity of 121,000 k.w. (151,250 kva. at 80 per cent. pf.) in twelve steam turbines as follows: 2—2,500 kva., 2—3,750 kva. (house machines), 1—6,250 kva., 3—12,500 kva., 2—22,500 kva., and 2—25,000 kva. These turbines were placed in commission at various dates from 1913 to 1923; units Nos. 1 and 2 (5,000 kva.) in 1913, No. 5 (12,500 kva.) in 1917, No. 6 (6,250 kva.) in 1918, No. 7 (12,500 kva.) in 1920, No. 4 (12,500 kva.) replacing the original Nos. 3 and 4 and Nos. 8 and 9 (45,000 kva.) in 1921, and Nos. 10, 11, 12 and 13 (57,500 kva.) in 1923. Nos. 12 and 13 are primarily intended to supply auxiliaries and are designated as house sets. They are directly connected to a 6,600 volt auxiliary bus and thence through step up transformers to the main 22,000 volt bus.

Two additional turbo generators having a capacity of 25,000 kva. each are now under construction and will be placed in commission during the present year, thus bringing the installed plant capacity up to 161,000 k.w. (201,250 kva.) by the end of 1929.

Twenty-six boilers in three sections or groups of 8, 8 and 10 each, equipped with mechanical stokers, economizers, superheaters, induced, forced or balanced draught and partially with air preheaters supply steam at 200-lbs. pressure 600°F. temperature to the present turbo generators. Four additional boilers, equipped with Lapulco System powdered fuel firing, forced and induced draught, superheaters, economizers and air preheaters now under construction, will supply steam at 375 lbs. pressure 700°F. temperature for the two new turbo generators and will be connected through reducing apparatus with the present boiler house.

Coal is obtained under contract from Japan and northern China and delivered from steamer to the plant by tugs and lighters belonging to the Department and thence into storage or bunkers by electrically driven coal transporters and belt or bucket conveyors.

Ashes are removed from plant to hopper bottom steel lighters by tipping trucks shunted by electric locomotives and are sold to contractors or dumped near the mouth of the Yangtze river approximately 14 miles distant.

Cooling water is taken from the Whangpoo River at the site and make up feedwater from the city water system.

Direct current is supplied for operation of auxiliaries and other purposes by rotary converters and motor generators.

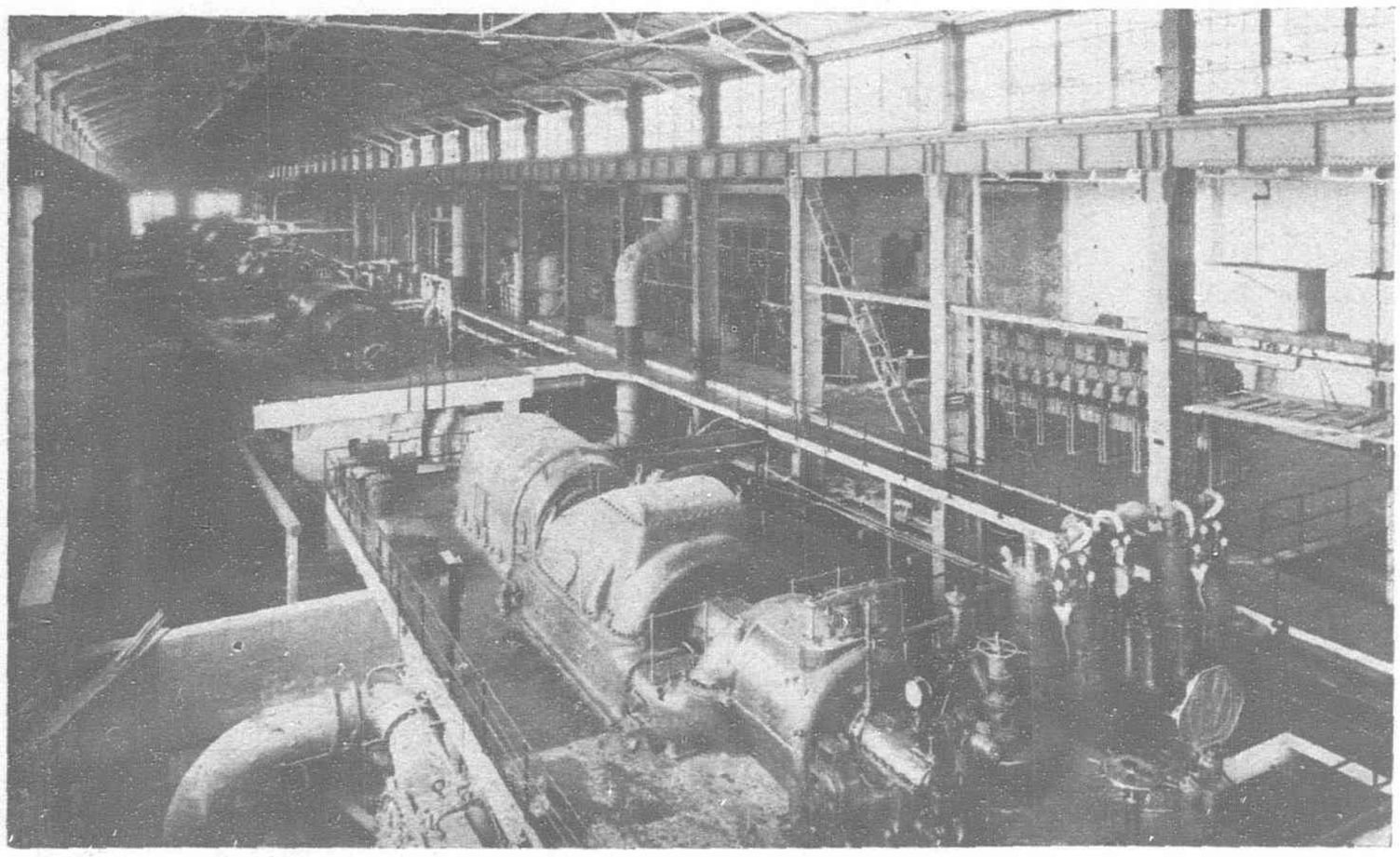
Alternating current for operation of auxiliaries and other purposes is supplied at 350 volts by transformation from an auxiliary 6,600 volt bus direct connected to house sets Nos. 12 and 13 and also through step down transformers to the 22,000 volt bus.

There are two sets of station busbars, one at 6,600 volts and the other at 22,000 volts. Generators Nos. 1-2-4 and 6 are connected to the 6,600 volt system and the remaining generators and the 6,600 volt busbars are connected through suitable transformers and switchgear to the 22,000 volt system.

Intercommunication is provided by 3—100 number automatic telephone sets, one of which sets is located at Riverside Power Plant, one at Department Headquarters on Foochow road and the other in one of the main substations on Fearon road.

An efficient laboratory is equipped for the complete analysis of coal, water, oil, paint, metals and other stores.

Riverside Power Plant building is partially (*i.e.* the older boiler house) steel frame with corrugated iron covering, partially (*i.e.* generator room, transformers, electric control and switch house, offices, laboratory and restaurant) steel frame with brick



View of Turbine House.

walls or reinforced concrete, and partially (*i.e.* extension for two new 25,000 kva. units) steel frame with metal lath and plaster covering. When the new work is completed and scaffolds and building material removed, it will present a good and substantial appearance.

In addition to the power plant there are at the site well equipped machine and blacksmith shops and general storehouse housed in a separate building and storage yards for poles and other materials.

The original site contains approximately 103 mow (17 acres) but an additional 90 mow (15 acres) adjoining has been acquired for a new additional power plant making a total of approximately 32 acres of land in the whole parcel.

DISTRIBUTION.—Transmission from Riverside plant at 22,000 volts underground to six primary substations stragetically located, five of which, *viz.*, Yangchow, Fearon, Connaught, Tonquin and Robison, are within the International Settlement limits and *viz.*, Brenan, is west of railroad on a Settlement road, but outside the Settlement limits. Further reference will be made to this situation in describing the territory served.

Two consumers are supplied by privately owned 22,000 volt substations. One of these contains transformers and metering equipment belonging to the Department and the other contains metering equipment only belonging to the Department.

These primary substations are planned generally for 40,000 kva. capacity each and are intended primarily to serve as centers for transformation from 22,000 volts to 6,600 volts for local distribution. Reference to the map and an inspection on the ground indicates that including Riverside 5,600 volt bus as one such center, these primary substations are well located for the purpose. They are generally interconnected by 22,000 volt underground cable for loop operation. It is planned to construct an additional primary substation on Park Road just north of the Shanghai Race Club, the site for which has been acquired, and, probably with additional factory building in the Eastern District additional primary substations will be required within the next five years in the territory between Riverside Plant and Yangchow, the first present substations to the west of Riverside.

While these substations are intended primarily for transforming from 22,000 to 6,600 volts they are used also for local 350 volt distribution and some of them contain synchronous condensers for power factor correction, direct current generators and motor generators for tramway and commercial direct current power, negative boosters for tramway load, public and private series lighting transformers and induction regulators. They are well designed, constructed and maintained and are exceptionally clean and orderly.

Radiating from these primary substations 6,600 volt feeders, approximately 80 per cent. underground and 20 per cent. overhead, run to (*a*) permanent secondary substations (*b*) temporary easily removable secondary substations or (*c*) transformers mounted on poletops. These secondary substations may be for the supply of a single large customer or for supplying a local network. In some cases they contain rotary apparatus for generating direct current and street lighting equipment.

Distribution is at 200/350 Y volts 4 wire, generally overhead with underground connection and pole riser from substation to first pole of network.

It is the general practice to build up load to approximately 225 k.w. on pole top transformers, then to install removable substations on land acquired for permanent substation site and then to build up to approximately 1,000 k.w., depending somewhat upon local prospects and general conditions, and thereafter to install permanent secondary substations and dismount the removable substation.

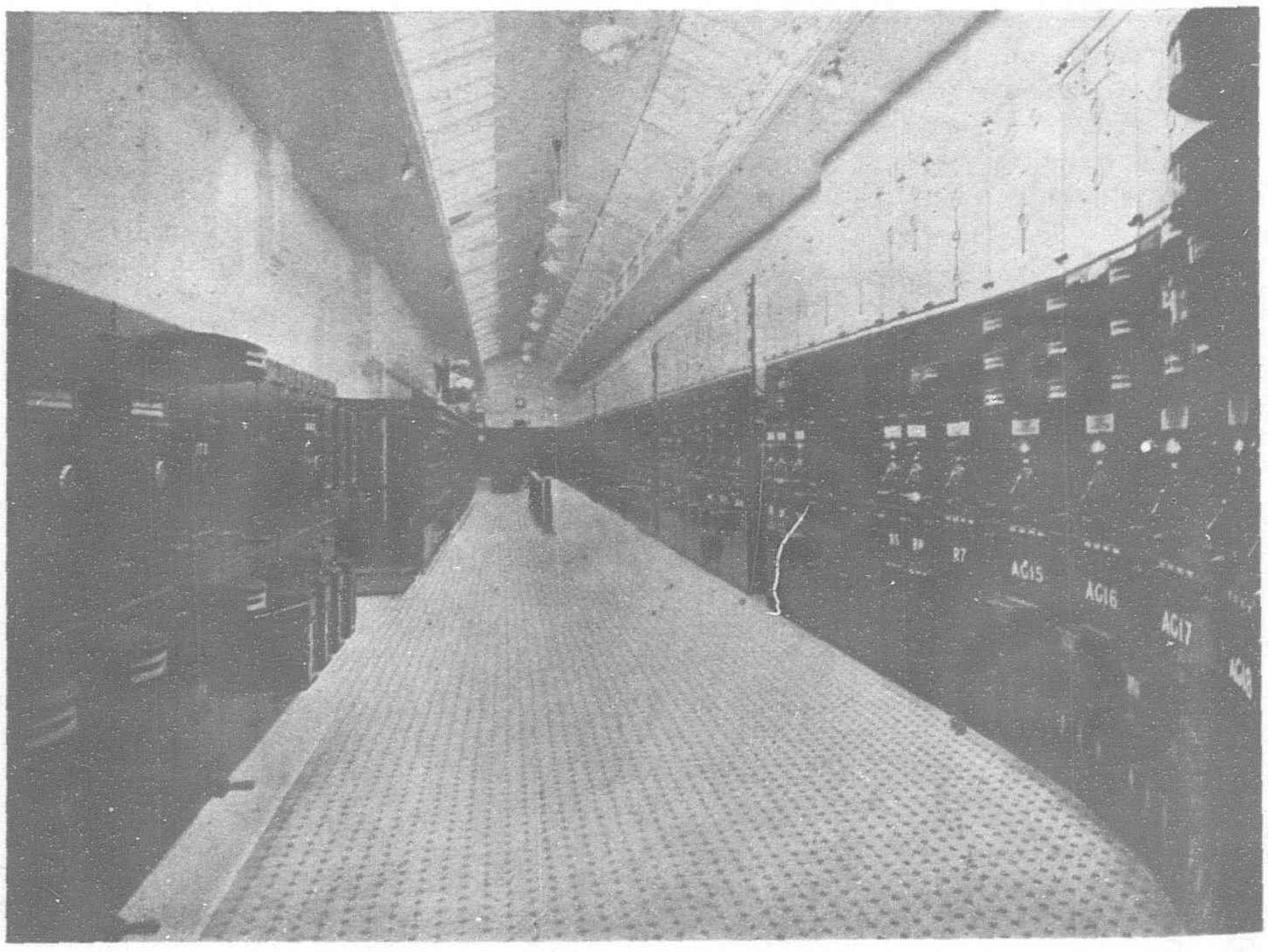
Voltage regulation in outlying districts 3 per cent. to 5 per cent. up and down. In congested districts 2 per cent. up and down. Frequency regulation better than 1/2 of 1 per cent.; continuity excellent, practically no interruptions.

Permanent substations are of ferro-concrete frame brick panel construction and present an unusually good appearance. Inside they are simple, the arrangement is excellent, they are well constructed and kept clean and orderly. Safety first devices are installed generally to prevent employees and others from coming in contact with high voltage wires.

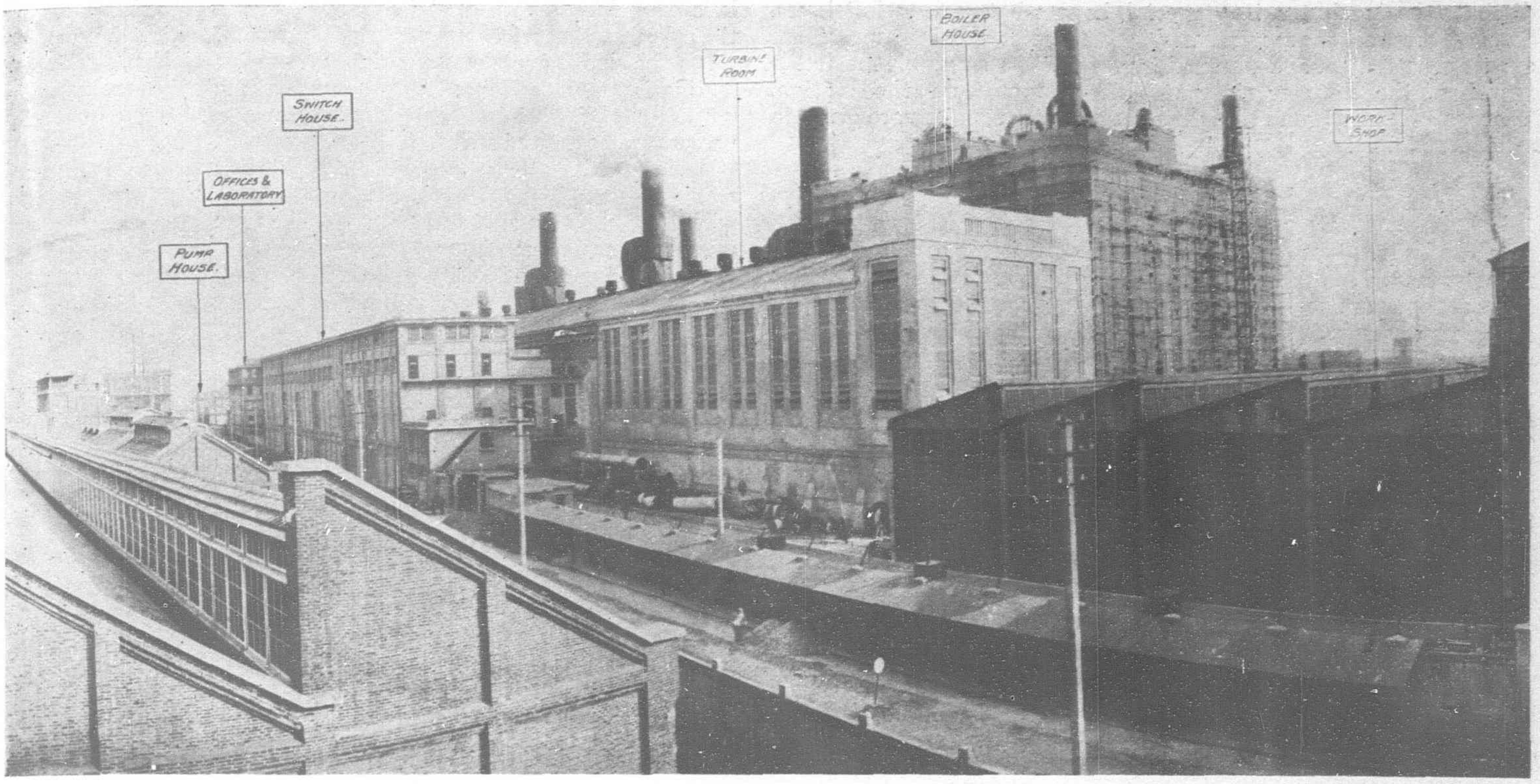
There are 169 secondary substations of the permanent or temporary type of which 57 are the property of the Department and 112 of consumers, and 81 pole top installations.

Direct current at 550 volts is supplied is the central business section for the operation of hoists and lifts, the Department reserves the right to suspend service between 1 and 5 o'clock a.m.

Public or private street and/or alley lighting is practically all 7.5 ampere constant current series incandescent 25 lamps to the circuit but there are a few 4.5 ampere lamps which are being replaced as rapidly as practicable by 7.5 ampere circuits and not over 2 per cent. of multiple incandescent lamps. There are no arc lamps.



Interior View of Control Room.



Detail of the Arrangement of the Riverside Plant.

Electric Power Requirements

THE SYSTEM PEAK kwh. and load factor for each of the preceding five years were :

		1924	1925	1926	1927	1928
Max. recorded peak on Generators	...kw.	66,200	77,000	90,000	90,000	90,000
Max. 30 min. load on Generators	...kw.	66,200	76,600	89,600	89,600	98,500
Increase over previous year...	...kw.	568	10,400	13,000	—	8,900
" " " " ...	...%	.87	15.8	17.0	—	9.9
Max. load on outgoing feeders	...kw.	63,459	72,930	86,105	86,025	95,250
Increase over previous year...	...kw.	546	9,471	13,170	—	9,225
" " " " ...	...%	.87	14.9	18.06	—	10.7
System load factor based on 30 min. peak on generators ...	...%	62.3	53.06	61.79	59.91	61.00

There are no curve drawing or maximum demand instruments on total load and the records show observed maximum on half hour readings. It is stated, however, that peaks other than those recorded very rarely occur since there are no fogs, and tropical storms do not affect the load appreciably. The load is remarkably steady and free from swings. Maximum loads occur in winter (December or January) and minimum loads in summer (July or August). The mid point on the rising curve usually occurs in early October and on the falling curve between February 15 and March 15.

During the past ten years the average annual increase in the 30 minute peak load on generators has been 7,649 kilowatts and on delivery to outgoing feeders 7,413. During the same period the annual load factor on generators has increased from 55 per cent. to 61 per cent. or 6 per cent. and the average annual increase in kilowatt hours sold was 37,208,556.

Steam Electric Power Production

1. RIVERSIDE POWER PLANT.—The site is on the north bank of the Whangpoo river, approximately five miles from, and east of, the bund in Shanghai.

A detail description of the generating plant is given below in the sequence of coal handling, boiler house, turbine house, switch house.

Coal Handling Plant

TUGS, LIGHTERS, COAL TRANSPORTERS AND CONVEYORS.—All coal consumed in the plant is sea-borne from Northern China and Japan in shipments varying from 3,000 to 6,000 tons. The vessels anchor in midstream, generally opposite the station's foreshore and wharf. Delivery is taken over the sides of the ships into the Department's steel lighters of which there are sixteen, *viz* : twelve, 200 tons and four 300 tons capacity. These steel lighters are handled between the ships and the wharf by two 350 h.p. tugs, the property of the Department. All lighters are provided with covers and locks to prevent theft. Details will be found in schedule No. 1 attached hereto.

The coal is discharged from the lighters by three electrically driven coal transporters, details of which will be found in schedule No. 2 attached hereto, and after automatic weighing is deposited on conveyor belts, and a bucket conveyor (the latter in the case of the smaller transporter), by which means it is delivered directly to the Boiler House bunkers, or to the short storage ground as required.

WEIGHING.—The coal is weighed in three automatic machines, those of the 40 ton per hour and the 100 ton per hour transporter are stationary, and that of the 70 ton per hour transporter is integral with the trolley. As will be gathered from the Coal Supply Specification the weight of coal paid for is that as registered by these scales, and a check against the weighing is always available by comparison with the records of readings of the draught gauges with which each lighter has been fitted after careful calibration of the lighters.

COAL STORAGE.—Normally the stock of coal is maintained at approximately 35,000 tons, which is sufficient, at the present rate of consumption, for about one month, allocated as follows :—

(*a*) Boiler house bunkers	4,000	tons.
(*b*) Short storage bunkers	1,000	"
(*c*) Short storage ground	10,000	"
(*d*) Emergency storage ground	20,000	"

The coal in (*b*) is deposited and reclaimed by bucket conveyors, and that in (*c*) is deposited by a conveyor belt bridge and reclaimed by a bridge grab.

The coal on the emergency ground is deposited and reclaimed by basket-carrying coolies, and is regarded entirely as stock for use in the event of industrial trouble at the mines or in shipping. Arrangements are made for its removal and replacement if not used within two years.

The short storage bunker and short storage ground referred to above, with its equipment for mechanical handling, is generally sufficient to provide the margin between plant demand and deliveries.

Ash Handling Plant

The ashes from the boilers are deposited direct into the ash tipping trucks. The latter are shunted by electric locomotives to a wharf specially provided for this purpose where they are

discharged *via* chutes into special hopper-bottom steel lighters. Some of these ashes are purchased by contractors, and the remainder are transported to, and dumped in, deep water at a point near the mouth of the Yangtze river 14 miles distant from the station. There are four 100 ton ash lighters in all. (Particulars are given in schedule No. 1).

Boiler Plant

The boiler plant may be regarded as consisting of four sections, namely, Nos. 1, 2, 3 and 4 boiler houses. The boilers in the first three sections are coupled to a common range and operate normally at a steam pressure of 200 lbs. per square inch and final steam temperature 600°F. This part of the plant is known as " A " station. All boilers in these sections are equipped with mechanical stokers. Details as to rating, types of boilers, types of stokers, draught system and dates of commissioning, etc. are given in schedule No. 3. From this it will be noted that two of the larger boilers in No. 3 section are fitted with air preheaters, the fitting of similar equipment to six other boilers in this section is now being proceeded with.

The plant in No. 4 Boiler House now under construction will operate at a steam pressure of 375 lbs. per square inch, final system temperature 700°F. This plant is known as " B " station and will supply normally the new turbine plant now being installed, and which is designed for this higher pressure and temperature. This plant is also connected to the 200 lbs. per square inch steam range through reducing valves and a steam desuperheater. The Lopulco bin and feeder system of pulverized fuel firing has been adopted. The burners are of the vertical type, and in addition to the tubes forming the water screens, Murray fin tubes form the side walls and back wall in each boiler. Details as to rating, types of boilers, preheaters, etc. are given in schedule No. 3.

Boiler House Instruments.—Each boiler is equipped with a feed water Venturi meter, C02 meter, steam flowmeters and all the instruments necessary for efficient operation, from which data is obtained and records made for the purpose of determining the efficiency of individual boilers and plant heat balance.

Feed Pumps and Tanks.—With the exception of four pumps and one tank in No. 1 Boiler House the whole of this equipment is contained in a separate Bay or section of the building between the Boiler House and Turbine House. All pumps, with the exception of Nos. 3, 4, 7 and 8, are of the rotary type steam turbine and electrically driven. Details as to capacity, type, and date of commissioning are given in schedule No. 4.

The feed tanks or hotwells are all enclosed, steam sealed, and all condensate from the turbines is delivered at the bottom of these tanks with the object of eliminating aeration as far as is possible. The normal water level in these tanks is approximately 21 feet above the centers of the pumps.

Feed Water Heating.—Practically all the condensate from the turbo sets up to No. 11 set (that is, the plant in " A " station) is initially heated by passing through the condenser of the running house service turbo alternators, and then through auxiliary heaters supplied by steam from the exhausts of the air ejectors of the main condensers. By this means the temperature of the condensate feeding the boilers in "A" station is raised to approximately 195°F before reaching the inlets of the economizers. It should be explained that the house service turbo alternator sets, of which there are two, serve the dual purpose of supplying a section of the " A " station auxiliaries and feed heating, the vacuum at the exhaust being normally about 15-in. Hg. These sets are referred to in detail under supply to auxiliaries.

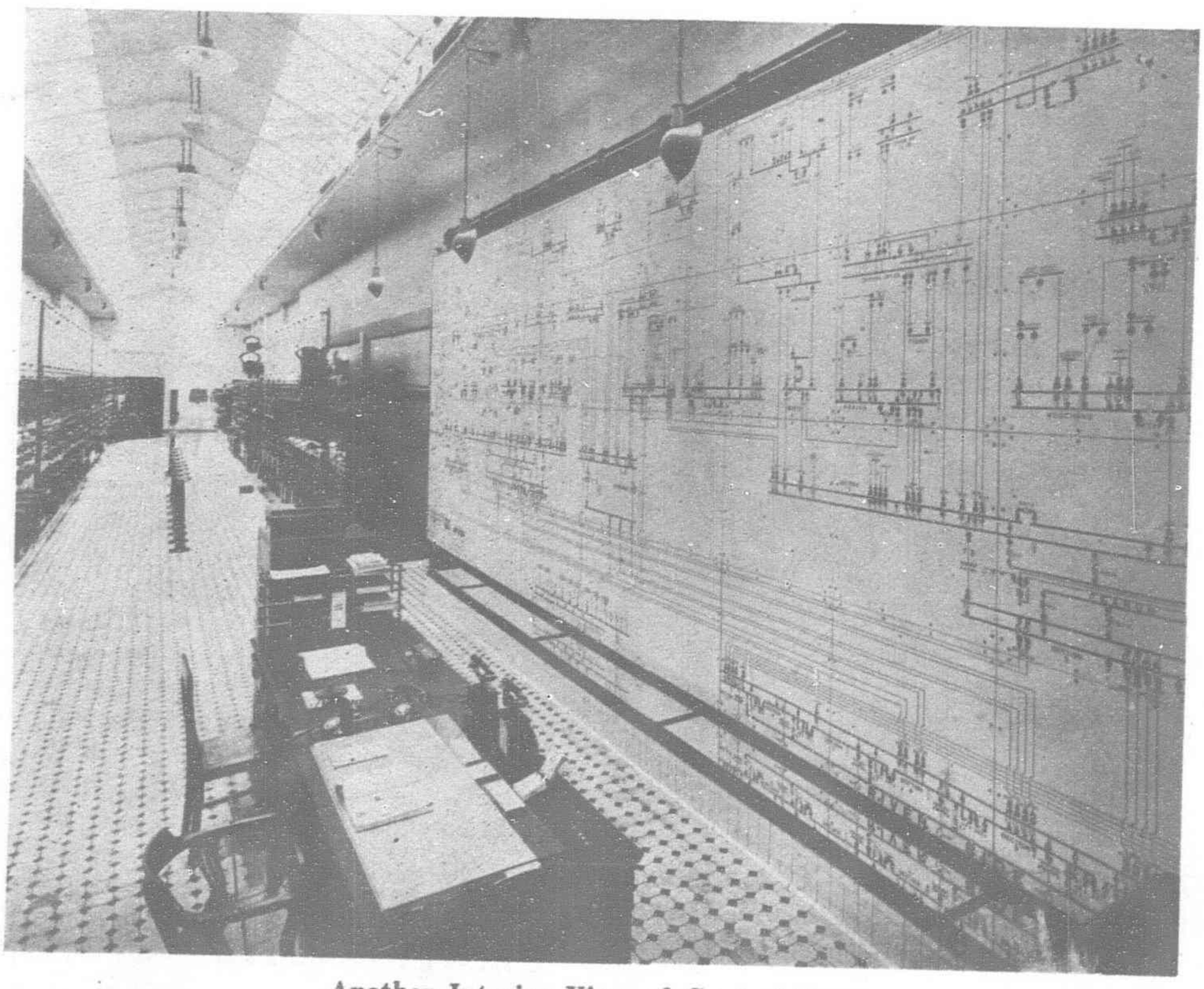
The feed water system in " B " station, that is, the higher steam pressure plant, is entirely separate from that in " A " station, with the exception that in emergency the feed tanks can be coupled up through a common bus pipe. Initial feed heating is effected by stage bleeding. On No. 14 turbo set two-stage bleeding is employed with the heaters placed between the condensate extraction pump and the feed tanks. On No. 15 turbo set three-stage bleeding is employed, two heaters being located between the extraction pump and the feed tank, and the third heater on the discharge side of the boiler feed pumps. By this means the temperature of the condensate is raised to 220°F before reaching the inlets to economizers in " B " station. Special precautions against aeration are being taken by sealing the tanks, employing steam air ejectors, admitting condensate to the feed tanks at the bottom, and admitting make-up water to the system *via* the main condensers.

Turbine House

Schedule No. 5 shows at a glance the turbine house plant with the details of ratings, turbine auxiliaries and dates of commissioning, etc. Turbo sets Nos. 1, 2, 4, 5, 6, 7, 8, 9, 10, 11 and house service sets 12 and 13 operate at 195 lbs. per square inch, final steam temperature 585°F, and this part of the plant will be known as " A " station. A view of the interior of the turbine house taken from the north end and from the south end is shown in photographs Nos. 238 and 284 respectively.

The following will be noted from the schedule mentioned above: All condensate extraction pumps are of the centrifugal type and are electrically driven, with the exception of two standby pumps on Nos. 8 and 9 sets which are steam driven, and for all sets from No. 8 upwards condensate extraction pumps and vacuum pumps are duplicated. On all the larger units steam air ejectors are employed for condenser air extraction. Those on Nos. 5 and 7 sets have been recently installed to replace in one case a rotary air pump, and in the other case a reciprocating air pump with the object of eliminating aeration as far as is possible.

Turbine House Instruments.—Each turbo alternator set is equipped with a condensate Venturi meter, temperature indicating and recording meters, and all the instruments necessary for efficient operation, maintaining a check on the performance of individual turbo sets and for providing the data necessary for compiling station heat balance records. In addition the turbine house is equipped with calibrated test tanks, and by means of a system of piping the condensate from any turbo set can be accurately measured in these tanks for the purpose of checking the condensate meters and or obtaining accurately at any time steam consumption date.



Another Interior View of Control Room.

Alternators.—All alternators operate at 6,600 volts. Sets Nos. 1, 2, 4 and 6 generate direct on to the 22,000 volt section through step-up transformers, as also will Nos. 14 and 15 sets when completed. Nos.

12 and 13 turbo alternators, which are house service sets for supply to auxiliaries, generate on to the 6,600 volt auxiliary supply switchboard, and the latter is in turn connected *via* interconnector transformers to the 22,000 volt section. These are referred to in detail under supply to auxiliaries.

Each turbo alternator derives its excitation current from a direct coupled exciter. All alternators installed after the year 1920, *viz* : Nos. 8 to 15, are fitted with ventilation equipment of the enclosed type, in which connection river water is employed as the cooling medium.

Condenser Circulating Water System

Circulating water is drawn from the Whangpoo River which is tidal, the maximum rise and fall being 12 feet. The pumping plant is situated on the river bank, and is divided into three sections, namely, Nos. 1, 2 and 3 Pump Houses. Details of the pumps installed will be found in schedule No. 6, the location of the pumps being as follows :

No. 1 Pump House—Pumps Nos. 13, 14, 15 and 16.
„ 2 „ „ — „ „ 4, 5, 6 „ 7.
„ 3 „ „ — „ „ 8, 9, 10, 11 and 12.

Rotary screens are fixed at the mouth of the intake channels to Nos. 1 and 2 Pump Houses, and there are stationary screens covering the intake channel for No. 2 Pump House.

No. 1 Pump House, as its number implies, was the first constructed, and contained originally three small circulating pumps. The circulating water required for the present extensions has been catered for by replacing these pumps by four larger ones, namely, Nos. 13, 14, 15 and 16 already referred to.

All pumps are of the centrifugal vertical spindle type, A. C. motor driven. The pumps are contained in chambers of concrete construction, the pump centers being two feet below low tide level so that under all conditions of tide the pumps are flooded.

The delivery pipes are in the main lapwelded steel with short cast iron sections, branches and make-up pieces. These are run underground between the Pump House and Turbine House, and are above basement level inside the turbine house.

The circulating water system is syphonic, each condenser discharging into an underground culvert common to all sets, running along the east side of the turbine house round the north side of the station and discharging into an open channel on the west side, connecting with the Whangpoo river at a point 200 yards from the intake.

Transformers

The transformers are situated and grouped as follows :—

1. In the turbine house and feed pump bay for supply to auxiliaries and rotary converters.
2. In the circulating pump houses for supply to circulating water pumps.
3. In the basement below the first section of the 22,000 volt switchgear, this group comprising 6,600 to 22,000 step-up transformers for Nos. 5 and 7 generators, and the interconnector transformers between the 6,600 and 22,000 volt sections ; also 22,000/350 volt transformer for auxiliary supply.
4. In a transformer bay at turbine platform level running parallel and adjacent to, but quite separate from, the turbine house. This group comprises 6,600 to 22,000 volt step-up transformers for Nos. 8, 9, 10, 11, 14 and 15 generators and the inter-connector transformers between the 6,600 volt auxiliary supply section and the 22,000 volt bus bars. In the latter it will be noted that there is a rail track and bogey running parallel to these transformers which provide facilities for quickly replacing when necessary transformer units by the spares which are kept available for this purpose in this section.

Transformer Cooling :—Groups Nos. 1 and 2 are air cooled. Group No. 3 are river water cooled by pipe coils in the oil, and the cooling of the transformers in group No. 4 is effected by circulating oil through separate coolers, the cooling medium being river water. The equipment for the latter is situated in the basement immediately below the transformers, and includes filtering apparatus and transformer oil storage tanks.

Details of transformers including type, rating, dates of commissioning, etc., are given in schedule No. 7 attached hereto.

Main High Tension Switchgear 6,600 and 22,000 Volts

There are two adjacent switch houses, one containing the 6,600 volt main switchgear, and the other the 22,000 volt main switchgear. These are situated on the east side of the station, and are parallel to the Turbine House. Details of the switchgear installed and dates of commissioning are given in schedule No. 8, which also indicates the extensions which have been made from time to time. The whole of the switchgear is of International General Electric and British Thomson Houston manufacture, and is of the cellular type. The building is of steel and reinforced concrete, as is also the cell construction. The cable trifucating boxes and lightning arrestors are contained in the basement. Bus bars, isolating and selecting links, protective gear and instrument transformers are on the first floor, oil switches and reactances are on the second floor, and oil switch operating mechanisms on the third floor.

On both the 6,600 volt and 22,000 volt sides there are three sets of bus bars, namely, main or section bars, auxiliary or hospital bars and tie bars. The set of 22,000 volt main or section bar, as its name implies, is sectionalized with approximately 20,000 k.w. of generating plant on each section. These sections can be coupled solid by coupler switches or through reactors, for which purpose the set of tie bus bars is employed. The 22,000 volt auxiliary or hospital bar is continuous, and can be connected to sections of the main 22,000 volt bar by bus paralleling switches.

Connection between the 6,600 volt main section and the 22,000 volt main section is made *via* interconnector transformers.

As previously mentioned under " Alternators " sets Nos. 1, 2, 4 and 6 generate direct on to the 6,600 volt bus bars, sets Nos. 5, 7, 8, 9, 10 and 11 generate on to the 22,000 volt bus bars through step-up transformers, as also will Nos. 14 and 15 sets when completed.

Control Room :—The control room is situated between, but quite separate from, the turbine house and switch house. The following apparatus is operated and controlled from this point :—

All 22,000 volt main oil switches, all 6,600 volt main oil switches, the oil switches on the 6,600 volt house service auxiliary supply board in " A " station, the oil switches of the 6,600 volt auxiliary supply board in " B " station, governor and excitation controls of all turbo generators, emergency turbine stop valve and main field switch tripping gear. The temperature indicators of the distance temperature equipment of the generators and main transformers are also installed in this room, from which a record of quarter hourly readings is made.

In addition to the station control mentioned above, high tension network control is also carried out from this point by the System Control Engineer, and a diagram of the whole of the high tension network with hand-manipulated dises to indicate the positions of switches, isolators and selectors is a part of the control room equipment.

By a system of automatic telephones communication can be established between the control room and any substation on the network, or any part of the station or offices. Provision is also made for wireless communication in emergency between the control room and the central office which is five miles distant from the station.

Supply to Auxiliaries

With the exception of two circulating water pumps which are operated from a supply pressure of 6,600 volts, all other electrically driven auxiliaries are 350 volts A.C. or 440 volts D.C. The latter supply is employed in all cases where speed control is required, such as forced draught and induced draught fans.

In order to ensure continuity of supply to auxiliary plant under all conditions supply is given to the auxiliaries of approximately 80,000 k.w. of generating plant from the house service turbo-alternator sets already referred to under " feed water heating " and " alternators." Of these there are two 3,000 k.w. each, one set being standby to the other. These house service sets generate direct on to a 6,000 volt auxiliary supply switchboard, which in turn is connected to the 22,000 volt section through two 4,000 k.w. interconnector transformers. The switches controlling same are fitted with reverse power relays, the function of this apparatus being to automatically disconnect the house service supply from the main 22,000 volt bus bars in the event of irregularities or heavy faults on the main 22,000 volt system such as would cause the house service sets to generate into that system with a consequent reduction of frequency and voltage. Under normal circumstances the running turbo set is kept floating with the main 22,000 volt system, *i.e.*, supplying only the auxiliaries connected to the house

service supply switchboard, but under certain conditions the leading is adjusted for feed water temperature regulation.

The electrically driven auxiliaries in " A " station are supplied as follows : Approximately 65 per cent. from the house service turbo set, and the remainder from the main 6,600 volt and 22,000 volt sections. 440 volt D.C. supply is obtained through rotary converters normally connected to the above mentioned house service auxiliary supply switchboard.

The electrically driven auxiliaries in " B " station will be supplied from one of the 22,000 volt section in " B " station through a 22,000/6,600 transformer to a 6,600 auxiliary switchboard, and from this board through 6,600 to 350 volt transformers to 350 volt distribution boards. 440 volt D.C. supply to the auxiliaries in " B " station will be given by a motor converter normally supplied from the 6,600 volt board in this station.

Provision is made for connecting the 6,600 volt house service auxiliary supply board in " A " station to the 6,600 volt auxiliary supply board in " B " station, and a double bus bar arrangement permits of auxiliaries in either station being supplied from either source.

Distribution to the D.G. auxiliaries in " A " and " B " station is effected through a D.C. distribution board common to both. This board is also equipped with double bus bars whereby any distributor can be supplied from either source. All the rotary converters and the motor converter are connected to this board.

Electrical Connections

HIGH TENSION :—For all H. T. connections between generators, transformers, switchgear and other apparatus paper insulated lead sheathed armoured cables are employed, with the exception of the short connections between the generators and step-up transformers from No. 8 set upwards. For these connections which are short and heavy, bare copper on insulators in concrete conduits has been adopted.

LOW TENSION :—For the main connections paper insulated lead sheathed wire armoured cables are employed, and for the sub-circuits to station auxiliaries, etc. paper insulated lead covered armoured cables, vulcanized braided and armoured cables, and cambric insulated lead sheathed armoured cables are employed.

Workshops

The workshop is equipped for smiths and platework, carpentry, machining and fitting ; also for the winding and testing of electrical machinery and apparatus, and caters for both manufacture and repair work for all departments, namely :—generation, distribution and consumers.

Laboratory and Generation Operation

Statistical Section

The laboratory is fully equipped for the complete analysis of coal, water, oil, paint, metals, and other stores. Each day the laboratory collects the running data, average charts, etc., and enters the turbine data in its respective books, and averages all figures to produce the daily reports. At the end of each week, all data is collected and summarized in two efficiency reports.

INSTRUMENTS :—The usual power station instruments, approximately 250, are kept in order, charts changed daily or weekly as the case may be, and data collected and summarized. The instruments controlled are recording pyrometers and thermometers, venturi meters, draft gauges, C02 recorders and pressure gauges Electrical instruments belong to the electrical department.

BOILER AND COAL TRIALS :—All data connected with boiler trials and coal trials are collected by the laboratory and results presented in a summarized useful form.

CHEMICAL WORK :—The coal is delivered in 3,000 to 6,000 ton shipments, being transferred from the ship to 200 and 300 ton lighters. From each lighter, samples are taken for analysis and moisture. As it is bunkered, the coal is tempered at about 10 per cent. to 12 per cent. moisture and samples are taken from each boiler shute to ascertain if tempering has been correctly done.

Boiler waters are analyzed continuously for concentration. Leakage tests are performed on each condenser twice daily and aeration of food water daily. Flue gasses are analyzed continuously 24 hours a day for C02.

INTERMITTENT ANALYSIS :—The coal is bought on a calorific basis and each consignment is analyzed in duplicate so that all deliveries are checked against the specification. Water analyses are carried out when required as also are ultimate analyses on the coal, *e.g.*, when special boiler trials are run or when basis data is required.

Transmission and Distribution System

For the purpose of maintenance and construction the area is divided into three parts each with its own depôt, as follows, *viz* :

(1) Eastern District area, East of the Hongkew Creek, Depôt at Yangchow Road.
(2) Central District area, between the Hongkew Creek and Thibet Road, Depôt at Fearon Road.
(3) Western District area, West of Thibet Road, Depôt at Haiphong Road.

EASTERN DEPÔT, YANGCHOW ROAD :—Total area of site 36,930 sq. ft. Buildings erected on site are as follows :—

(2) Depôt offices, sub-stores, workshop and tool rooms.

This is a substantial ferro concrete frame, brick panel building measuring 145 ft. long 70 ft. wide and 12 ft. high built for extension to two storey building when necessary. Floor area of building at present 7,660 sq. ft. Only minor repairs are carried out in workshop, the equipment of which is as follows :

1 Drilling machine
1 12-in × 6-in. Horizontal lapping machine
1 Machine hack saw
1 10-in. Grinding and buffing machine

(*b*) 22,000 volt substation building 150-ft. long, 56-ft. wide by 56-ft. high, described under 22,000 volt substations. Area of site 4,800 sq. ft.

CENTRAL DEPÔT, FEARON ROAD :—Total area of site 107,500 sq. ft. The following buildings are erected on this site :—

(*a*) Main stores building. (*b*) Meter Engineering Department. (*c*) Depôt offices, workshop, tool house, etc. (*d*) Main garage and garage, workshop. (*e*) Transport offices and Dispensary for Chinese staff and Consumers Department Office. (*f*) Oil treatment plant. (*g*) Fearon Road 22,000 volt Substation.

The main stores building is a substantial brick building with concrete floors and was formerly the old Fearon Road Power Station. Area of site 22,980 sq. ft., total floor area 59,440 sq. ft. The Meter Engineering Department building adjoining the stores building is of similar construction with a site area of 2,280 sq. ft. and a floor area of 10,900 sq. ft. This is divided up into offices, test rooms, workshops and stores. The whole of the Meter Department is housed in this building.

The Distribution Department Depôt building for offices, workshop, tool house, etc. is under construction. It is a two storey building of ferro concrete frame and brick panel construction and is 97-ft. 6-in. long, 36-ft. 6-in. wide and 28-ft. 9-in. high. Area of site 3,558 sq. ft., total floor area as being built at present 4,620 sq. ft. The offices will be located on the first floor and will accommodate the substation, overhead and underground staff operating from this depôt. The workshop and tool houses are on the ground floor. Equipment of workshop is as follows :—

1 4-in. centre lathe ; 1 Drilling Machine ; 1 Machine hacksaw ; 1 12-in. Grinding and buffing machine ; 1 12-in × 6-in. Horizontal lapping machine.

The main garage is a single storey steel frame building with brick walls on three sides and sliding doors in front, 188-ft. long, 44-ft. wide, 16-ft. high, floor area 8,272 sq. ft. The garage workshop is a two storey building of ferro concrete construction with brick panel walls, 75-ft. long, 60-ft. wide and 35-ft. high, area of site 4,500 sq. ft., floor area 9,000 sq. ft.

The Transport Consumers Department Office and Dispensary building is a single storey brick building with tiled roof 75-ft. long, 30-ft. wide, 15-ft. high, floor area 2,250 sq. ft.

The oil treatment plant is a single storey brick building with corrugated iron roof, 50-ft. long, 30-ft. 8-in. wide and 18-ft. high, floor area 1,553 sq. ft. All insulating oil used in the Distribution Department is treated in this plant. A special oil tank truck by Shelvoke & Drewery with two 600 gal. compartment transports the oil between the oil plant and the various substations. The equipment in the treating plant is as follows :—

1 Hydraulic Press hand operated for filter papers ; 1 Electrically heated oven for filter papers ; 2 Three thousand gallon Tanks ; 3 Nine hundred gallon Tanks ; 2 Five Hundred gallon Tanks.

By a system of pipes oil can be transferred from any one tank to another direct or through a filter. Two General Electric Filter Presses and one De Lavel centrifugal separator are installed and also a 50,000 volt testing transformer.

The Fearon Road Substation is a ferro concerte frame brick panel building, 161-ft. 6-in. long, 75-ft. 6-ft. wide, 53-ft. 0-in. high, described under 22,000 volt substations. Area of site 12,200 sq. ft.

EASTERN DISTRICT DEPÔT, HAIPHONG ROAD :—Total area of site 36,620 sq. ft. The present depôt buildings are of a temporary nature and the permanent building is under construction. This consists of a single storey building designed for future extension to a double storey building. It is of ferro concrete construction with brick panels, 145-ft. 6-in. long, 48-ft. 0-in. wide and 14ft. 0-in. high. Area of site 6,984 sq. ft. This building will house the Distribution Staff Offices working from this Depôt, workshop tool rooms and stores. Equipment of workshop is as follows :—

1 Drilling machine ; 1 Machine hack saw ; 1 12-in. × 6-in. Horizontal lapping machine ; 1 10-in. Grinding and buffing machine.

A small corrugated iron distribution Substation is situated in this Depôt.

22,000 Volt Substations

YANGCHOW ROAD SUBSTATION :—The building is of the ferro concrete frame, brick panel type, measuring 150 ft. long, 56 ft. wide and 56 ft. high. Provision is made for extension on roof to house reactors and reactor switches at a later date. The substation receives energy through five three-core split conductor feeders, two of .2 sq. in. and three of .15 sq. in. sectional area. Transformation from 22 kv. to 6.3. kv. is by three 12,600 kva. three phase banks of transformers, each consisting of three 4,200 kva. single phase units. There are ten of these units, one being spare. There are sixteen outgoing 6,600 volt feeders, two 3,600 kva. synchronous condensors, one 300 kva. public lighting transformer and six public lighting regulators.

Each synchronous condenser consists of a 6,300 volt 3,600 kva. condenser, driving a 600 k.w. 550 volt D.C. generator and 110 volt exciter. The D.C. generators supply current for the Tramway Company through a slate panel traction switchboard. A negative booster is installed for use in conjunction with Tramway Company's negative feeders. Both the 22 kv. and 6.3 kv. switchboards are of the concrete cellular type equipped with double bus bars and General Electric Company's H. 3 and H. 6 type circuit breakers, motor operated and remote controlled from a slate panel control board. The 22 kv. bus bars are of the tabular pattern and the 6.3 kv of flat bar. Rupturing capacity of oil circuit breakers is 22 kv. 500,000 kva. 6.3 kv. 350,000 kva. A 120 ampere hour battery and motor generator is installed. Protection : All 22 and 6.3 kv. circuit breakers have overload protection by means of current transformers and General Electric I.A. relays. In addition incoming 22 kv. feeders have Cole balance protection. Transformers have balance protection I.G.E. pattern. 6.3 kv. feeders have Merz-Price balance protection and where more than two are in parallel, earth leakage protection.

Below is a schedule of the switchgear equipment :—

Apparatus	Provision for	No. Installed
2 kv. feeders	8	5
,, ,, trans. banks	3	3
,, ,, Lightning Arresters	3	3
,, ,, Potential transformers	3	3
,, ,, Current limiting reactors	3	—
,, ,, Bus section switch	1	1
6.3 kv. feeders	21	20
,, ,, Lightning arresters	3	3
,, ,, Potential transformers	3	3
,, ,, Current limiting reactors	3	—
,, ,, Bus section switch	1	1

FEARON ROAD SUBSTATION :—This is a three storey building of ferro concerte brick panel construction, 161 ft. long, 75 ft. 6 in. wide and 53 ft. high. Energy at 22,000 volt is received through eight incoming feeders from Riverside Power Station. Six of these are of .15 sq. in. sectional rea, and two .2 sq. in. All are of the three core split conductor type. Two .15 sq. in. interconnector cables run from this substation to the Tonquin Road Substation. Transformation from 22 kv. to 6.3 kv. is by three 12,600 kva. three phase banks, each bank consisting of three 4,200 kva. single phase transformers, ten of which are installed—one being spare. Three synchronous condensers of 3,600 kva. capacity driving 600 k.w. D.C. machines for supply to the Tramway Company. Each synchronous condenser consists of a 6,300 volt 3,600 kva. condenser, driving a 600 k.w. 550 volt D.C. generater and 110 volt exciter. The D.C. generaters supply power for tramways. There is also one 300 k.w. motor generator set with Scott connected transformer, which was transferred from the old Fearon Road Power Station. Three negative boosters, similar to the Yangchow machines are in commission and a slate panel D.C. switchboard. Two 625 kva. 6,300/350/200 volt transformers are used for local low potential distribution network supply through concrete cubicle type switchboard. The 22 kv. and 6.3 kv. switchgear is of the concrete cubicle cellular type fitted with similar switches to those at Yangchow substation. Three 225 kva. 6,300/2,200 volt single phase transformers feed 23 series regulators for street lighting circuits. Protection similar to Yangchow Road. A 120 ampere hour battery and motor generator is installed. Below is a list of switchgear installed.

Apparatus	No. provided for	No. installed
22 kv. feeders	14	10
22/6.3 kv. Transfr. Switches	3	3
22 kv. Reactors	3	3
,, ,, Lightning arresters	3	3
,, ,, Bus potential transformers	3	3
,, ,, Bus section switch	1	1
6.3 kv. feeders	30	29
,, ,, reactors	3	3
,, ,, Lighting arrestors	3	3
,, ,, Bus bar potential transformers	3	3
,, ,, Bus section switch	1	1

TONQUIN ROAD SUBSTATION :—This is a three storey ferro concrete frame, brick panel building, 181 ft. long, 54 ft. 7 in. wide and 56 ft. high. An extra room has been constructed on the roof to house the 22 kv. reactor, bus coupler, switches, etc. Energy at 22 kv. is received through five feeders direct from Riverside, three of which are .2 sq. in. and two .15 sq. in. sectional area. There are also two .15 sq. in. cables from Fearon Road Substation. Two .2 sq. in. interconnector cables go to Robison Substation and one new .2 sq. in. incoming feeder from Riverside will shortly be commissioned. All of the three-core split conductor type. Transformation from 22 to 6.3 kv. is by three 12,600 kva. three phase banks, each bank consisting of three 4,200 kva. single phase transformers, ten of which are installed—one being spare. These transformers are connected star/delta and the 6.3 kv. side of each bank is earthed through an earthing transformer designed to pass 800 amps. Two 6,500 kva. synchronous condensers by I.G.E. are installed complete with starting meters and exciters and also a spare motor driven exciter. A 120 ampere hour battery and M.G. for switch operation. Two 625 kva. transformers 6,300/350/220 volt are installed for local distribution through a concrete cubicle type L. T. switchboard. The 22 and 6.3 kv. switchgear is of the concrete cubicle type fitted with H. type switches similar to these at Fearon and Yangchow.

Below is a schedule showing switchgear installed and allowed for :—

Apparatus	No. provided for	No. installed
22 kv. feeders	12	11
22 and 6 kv. Transformers	3	3
22 kv. Reactors	4	4
,, ,, Lightning Arrestors	4	4
,, ,, Potential Transformers	4	4
,, ,, Bus Section Switches	2	2
6.3 kv. Feeders	30	27
,, ,, Reactors	4	4
,, ,, Lightning Arrestors	4	4
,, ,, Potential Transformers	4	4
,, ,, Bus Section	2	2
,, ,, Bus Coupler	1	1

ROBISON SUBSTATION :—This is a ferro concrete frame brick panel building and was originally designed for a 22 kv. switch house only. The size of the building is 66 ft. long, 45 ft. 6 in. wide and 46 ft. high. The 22 kv. switchgear is of the cellular concrete cubicle type with British Thomson Houston three tank switchers of approximately 200,000 kva. rupturing capacity. These switches (12 in number) are being replaced at present by Metropolitan Vickers switches of 750,000 kva. rupturing capacity. There are two incoming feeders direct from Riverside Power Station, one interconnector from Connaught Substation and two from Tonquin Substation, all .2 sq. in. area. There are two .15 sq. in. and one .2 sq. in. outgoing cables to Brenan Substation, two .1 sq. in. to Naigai Wata Kaisha No. 13 Mill and two .15 sq. in. cables to Shi Ho Mill. Two transformer banks are now installed in this substation, one a 22 kv./360 volt 3,000 kva. bank consisting of four 1,000

kva. single phase units—one being spare feeding a local mill. The other bank consists of two 22/63 kv. 3,000 kva. three phase transformers feeding through two 6,300 volt switches and overhead lines to the Toyoda Mill. This bank is fitted with an 800 ampere earthing transformer on the 6.3 kv. side. One 110 ampere hour battery and booster is installed for switch operation.

BRENAN SUBSTATION :—This substation building is of the 1919 pattern Distribution Substation and has been equipped temporarily with three 3,000 kva, 22/6.3 kv. three phase transformers, one being spare. There is no 22 kv. switchgear but only isolators (*i.e.* disconnectors) on the incoming cables from Robison. The 6.3 kv. switchgear is also of a temporary nature and consists of I.G.E. F. K. 12 switches mounted on a pipe framework and also a B.T.H. truck type board. Lightning Arrestors are fitted on both the 22 and 6.3 kv. sides. An earthing transformer for passing 800 amperes is connected on the 6.3 kv. side of the main bank and a 6,300/350/200 volt 325 kva. transformer is installed for feeding the local network. A site, having an area of 33,657 sq. ft. approximately, has been purchased for the construction of a permanent 22 kv. substation but is as yet undeveloped.

CONNAUGHT SUBSTATION.—The area of the site is 26,000 sq. ft. Part of the buildings, consisting of traction and condenser room, control room and battery room, were erected in 1927. The present plant is housed temporarily in the condenser room and consists of two 12,600 kva. 22/6.3 kv. transformer banks, each bank consisting of three 4,200 kva. single phase units. There are two .2 sq. in. incoming 22 kv. feeders and one .2 sq. in. interconnector to Robison Substation. There is a six panel single B.B. 22 kv. switchboard fitted with B.T.H. breakers, similar to those at Robison. The 6.3 kv. board is a 13 panel concrete cell distribution substation pattern board with double bus bars, fitted with B.T.H. circuit breakers. A 6.3 kv. switch house under construction will house 33 compound filled ironclad type circuit breakers of 500,000 kva. rupturing capacity, twenty-two of which are on order. Also four 7,500 kva. 3 phase 22/6.3 kv. transformers are on order for this substation.

PARK ROAD SUBSTATION.—A site adjoining the present Distribution Substation has been purchased but not yet developed. Work will commence in 1930. The area of this site is 7,150 sq. ft.

6,300 Volt Substations

There are altogether 57 Distribution Substation buildings which are the property of the Department. Of these 41 are of ferro-concrete frame brick panel construction and sixteen are of wrought iron. The remaining 112 substations, transformer and switch house buildings are the property of consumers.

The forty-one substations above referred to are mainly of two types, one called the 1919 type and the other 1925 type. The former will take when fully equipped four 1,000 kva. transformers, one induction regulator and public lighting transformers and regulators, a 14 panel 6.3 kv. concrete cubicle type board and a twelve panel L.T. board. The 1925 type when fully equipped will accommodate two 1,000 kva. transformers, induction regulator and public lighting transformers, a 19 panel 6.3 kv. switchboard and a six panel L.T. board. The wrought iron type substation will accommodate a 625 kva. transformer, four 6.3 kv. switches and four L.T. circuits.

Transformers are mostly of the following standard sizes, 325, 625 and 1,000 kva.

Pole transformers of which there are 86 are of the following sizes 225, 125 and 62.5 kva.

Below is a summary of plant contained in the substations :—

	Total No.	Capacity kva.
(1) 22,000 volt Substations	8	—
(2) 22,000/6,300 volt Transformers	43	174,600
(3) 22,000/215 volt Transformers	8	12,000
(4) 6,300/350 volt Transformers	245	140,342½
(5) Induction Regulators	22	5,460
(6) Pole Transformers	86	14,255
(7) Public Lighting Transformers	25	2,312½
(8) Public Lighting Regulators	65	1,121
(9) Synchronous Condensers	7	31,000
(10) Auto Starting Transformers for Condensers ...	6	16,400
(11) D. C. Generators	5	3,000 kw.
(12) Rotary Converters	3	2,250 ,,
(13) Two phase Motor Generator	1	300 ,,
(14) Boosters Motor Generators, etc....	14	242 ,,
(15) 22,000 volt oil Circuit Breakers	61	
(16) 6.3 kv. Oil Circuit Breakers	710	
(17) L.T. Oil Circuit Breakers	245	

Overhead Mains

Overhead mains are run on 10 in. × 10 in. Oregon pine poles 35 or 40 ft. high mounted in concrete bases, the average pole spacing being 100 ft. The 6.3 kv. lines are mounted on the top of the poles, in the case of single circuit lines with two feet flat spacing and in the case of double circuit lines with two feet triangular spacing. The street lighting mains are run 2 ft. 6 in. below the 6.3 kv. lines, the size of wire used for these mains is 1/8 S.W.G. throughout. Section short circuiting and earthing links are placed at various points in the circuits. The low tension street mains are run 2 ft. 6 in. below the street lighting mains in all in. flat regular formation on shackle type insulators only. These mains are split into sections as requisite by either breaking brackets or paralleling switches which are worked from levers from the ground. All street mains are of bare copper, and the following standard sizes are now used. 37/12, 7/6, 6/8, 7/10 S.W.G. Service mains in alleyways and on private property are triple braided weather-proofed of the following standard sizes. 37/12, 7/6, 7/8, 7/10, 7/12, 1/5, 1/8, 1/10 S.W.G. Street lighting is all on the constant current 7.5 ampere series system fed by 15 or 20 kva. regulators from seven substations. Below is a schedule showing total number and size of lamps connected over a period of five years.

UNDERGROUND MAINS. 22 KV :—All mains laid up to 1927 were of the three core belted type with split concentric cores, paper insulated, load covered and double steel tape armoured laid direct in the ground. Since 1927 the type known as H.S.L. has been adopted. In this type each separate core is screened with either a metal tape or metalized paper and separately lead sheathed after which the three cores are wormed together and formed into one cable with single steel wire armouring. This type of cable eliminates troubles due to tangential stresses and to a great extent any trouble due to ionisation. It also increases the current carrying capacity due to better heat dissipation. All main feeders are either .15 sq. in. or .2 sq. in. in sectional area and sub-feeders .1 sq. in. or .15 sq. in. Attached is a diagram of the 22 kv. mains.

6.3 KV. CABLES :—These are all of the three core belted paper insulated lead covered and double steel tape armoured type laid direct in the ground. Standard sizes used for feeders and sub-feeders are .3 sq. in. .2 sq. in. .15 sq. in. .1 sq. in. Radial feeders for pole transformers are .025 sq. in.

LOW TENSION MAINS.—These are of the same type as the 6.3 kv. cables but only one size is used for feeders .4 sq. in. four core and for underground services .25 sq. in. four core. All 6.3 kv. and low tension overhead lines are fed from substations by underground cables except in outlying districts and in the case of pole transformers when they are joined direct. Three core and six core pilot cables are laid where necessary for the balance protection of the main feeders ; and dry core 10 lb. conductor, telephone cables for the automatic telephone system. The latter at present consists of three 100 line exchanges located one each in the Central Office.

Below is a schedule showing the amount of cable laid.

22 kv. Cable laid and in commission	165.68
6.3 kv. Cable laid and in commission	178.54
Low Tension laid and in commission	43.70
Telephone Pilot, etc.	100.17
Total	488.09 miles

At the present time four new 22 kv. trunks are being laid and will be commissioned shortly. These will add approximately 35 miles of 22 kv. cable to the total.

Power is transmitted from Riverside by 22,000 volt underground cables to five main substations which are well located to serve the present and prospective demand within the settlement and to one main substation outside Settlement limits. Plans are underway for an additional main substation located on Park Road, a short distance west of the race track, for which a site has been acquired. It is thought that one and possibly two more main substations will be required within the next five years in the eastern district between Riverside and Fearon Road. From Riverside and from the main substations, power is transmitted at 6,600 volt to secondary substations and at 200/300 volts to local distribution network.

SCHEDULE No. 1.

RIVERSIDE COAL AND ASH HANDLING PLANT

Twelve 200-ton steel coal lighters.
Four 100-ton steel hopper bottomed ash lighters.
Two Single screw 350-h.p. steel tow boats.

In commission end of 1924.

Four 300-ton steel coal lighters.

In commission beginning of 1926.

SCHEDULE No. 2.

CONVEYOR SYSTEM OF 24-IN. ROBINS BELTING

1. Belt Conveyor No. 2 feeding from No. 1 Transporter. In commission 1929. *Via* belts No. 3 and 4 to No. 2 Boiler House, also to No. 3 *via* belt No. 5 and 12.
2. No. 7 Belt feeding belts 8 and 15 *via* belt 9, 10, 11 and 12 feeding No. 3 Boiler House. In commission 1923. Belt No. 6 feeds storage *via* Bridge Conveyor.

Belt No. 6 feeds back to No. 2 Boiler House from No. 2 Transporter.
Belts 8, 9, 10, 11 and 12 in commission 1923.
Belts 5 and 6 in commission 1924.
Belt No. 15 in commission 1927.

SCHEDULE No. 3.

No. 1 BOILER HOUSE

Boilers Nos. 1—4 : (*B. & W.*)

Installed	December 1912.
Makers Rating	22,000 lbs./hour
Normal ,,	25,000 ,,
Maximum ,,	30,000 ,,
Chain Grates Area	150 sq. ft.
Induced Draught	
Fitted with Superheaters	
1 Green Economizer to 2 Boilers	

Boilers Nos. 5—8 : (*B. & W.*)

Installed	July 1915.
Makers Rating	28,000 lbs./hour
Normal ,,	35,000 ,,
Maximum ,,	40,000 ,,
Chain Grates Area	204 sq. ft.

Induced Draught. Fitted with Superheaters. Green Economizer to 2 Boilers.

No. 2 BOILER HOUSE

Boilers Nos. 9—12 : (*B. & W.*)

Installed	Latter part of 1918.
Makers Rating	40,000 lbs./hour
Normal ,,	45,000 ,,
Maximum ,,	60,000 ,,
Chain Grates Area	273 sq. ft.

Balanced Draught. Fitted with Superheaters and Babcock and Wilcox Superimposed Steel Economizers.

Boilers Nos. 13 and 15 : (*B. & W.*)

Istalled	Latter part of 1919.
Makers Rating	40,000 lbs./hour
Normal ,,	45,000 ,,
Maximum ,,	60,000 ,,
Chain Grates Area	273 sq. ft.
Balanced Draught	
Fitted with Superheaters and	
B. & W. Superimposed Steel Economizers.	

Boilers Nos. 14 and 16 : (*B. & W.*)

Installed	Latter part of 1919.
Makers Rating	40,000 lbs./hour
Normal ,,	45,000 ,,
Maximum ,,	60,000 ,,
Riley Stokers	13 retorts grate
Area	273 sq. ft.

Forced Draught. Fitted with Superheaters and B. & W. Superimposed Steel Economizers.

No. 3 BOILER HOUSE

Boilers Nos. 17 and 19 : (*B. & W.*)

Installed	Latter part of 1922
Makers Rating	80,000 lbs./hour
Normal ,,	90,000 ,,
Maximum ,,	110,000 ,,
Chain Grates Area	520 sq. ft.

Balanced Draught. Fitted with Superheaters and B. & W. Superimposed Steel Economizers. Ljungstrom Air Preheater ordered for 19.

Boilers Nos. 18 and 20 : (*Stirling*)

Installed	Latter part of 1922
Makers Rating	80,000 lbs./hour
Normal ,,	90,000 ,,
Maximum ,,	120,000 ,,
Riley Stokers No. 18	18 retorts
,, 20	20 ,,
Forced Draught	
Grate Area No. 18	314 sq. ft.
,, 20	348 ,, ,,

Fitted with Superheaters and B. & W. Superimposed Steel Economizers. Ljungstrom Air Preheater ordered for 20.

Boilers Nos. 22 and 24 : (*Stirling*)

Installed	Latter part of 1923
Makers Rating	80,000 lbs./hour
Normal ,,	90,000 ,,
Maximum ,,	120,000 ,,
Riley Stokers—20 retorts	
Grate Area	348 sq. ft.
Forced Draught	

Fitted with Superheaters and B. & W. Superimposed Steel Economizers. Ljungstrom Air Preheaters ordered for both boilers.

Boilers Nos. 21, 23 *and* 25 : (*B. & W.*)

Installed	Latter part of 1923
Makers Rating	80,000 lbs./hour
Normal ,,	90,000 ,,
Maximum ,,	120,000 ,,
Riley Stokers—19 retorts	
Forced Draught	
Grate Area No. 21	428 sq. ft.
,, 23 and 25	459 ,, ,,

Fitted with Superheaters and B. & W. Superimposed Steel Economizers. Ljungstrom Air Preheater fitted to No. 25, others ordered for 21 and 23.

Boiler No. 26 : (*Stirling*)

Installed	Beginning of 1924
Makers Rating	80,000 lbs./hour
Normal ,,	90,000 ,,
Maximum ,,	120,000 ,,
Riley Stoker—20 retorts	
Forced Draught	
Grate Area	428 sq. ft.

Fitted with Superheaters and B. & W. Superimposed Steel Economizers.

Boilers Nos. 25 and 26 fitted with Ljungstrom Air Preheaters—installed 1926.

No. 4 BOILER HOUSE

Boilers Nos. 27 and 29 : (*B. & W.*)

Installed	
Normal Rating	140,000 lbs./hour normal @ 375 lbs. pressure
Maximum ,,	185,000 ,, max. @ ,, ,, ,,

Lopulco System Powdered Fuel Firing
Forced and Induced Draught
Fitted with Superheaters and B. & W. Economizers and Tubular Air Preheaters
Lopulco System of Water Walls for Combustion Chamber.

Boiler No. 28 : (*Stirling*)

Installed	
Normal Rating	140,000 lbs./hour normal @ 375 lbs. pressure
Maximum ,,	185,000 ,, ,, @ ,, ,, ,,

Lopulco System Powdered Fuel Firing
Forced and Induced Draught
Fitted with Superheater and B. & W. Economizer and Tubular Air Preheater
Lopulco System of Water Walls for Combustion Chamber.

Boiler No. 30 : (*Stirling*)

Installed	
Normal Rating	140,000 lbs./hour normal @ 375 lbs. pressure
Maximum ,,	185,000 ,, ,, @ ,, ,, ,,

Lopulco System Powdered Fuel Firing
Forced and Induced Draught
Fitted with Superheater, B. & W. Economizer, and Howden-Ljungstrom Preheater
Lopulco System of Water Walls for Combustion Chamber.

SCHEDULE No. 4.—BOILER FEED PUMPS.

Local No.	Maker	In Commission	Steam or Electric	Rating	
				Lbs. per hour	Total head Lbs.
1	Rees Roturbo	1913	Electric	55,000	230
2	,,	1913	,,	55,000	230
3	Clarke Chapman	1913	SteamReciprocating	55,000	200
4	,,	1910	,,	50,000	230
5	Mather & Platt	1918	Electric	125,000	250
6	,,	1918	,,	125,000	250
7	Clarke Chapman	1918	SteamReciprocating	100,000	250
8	,,	1918	,,	100,000	250
9	Mather & Platt	1921	Electric	125,000	250
10	Jeansville, U. S. A.	1919	Steam Turbine	100,000	250
11	Holden & Brook	1922	Electric	300,000	250
12	Weirs	1922	Steam Turbine	270,000	250
13	Weirs	1922	,,	270,000	250
14	Holden & Brook	1923	Electric	300,000	250
15	Weirs	1922	Steam Turbine	270,000	250
16	Weirs	1922	,,	270,000	250
17	Weirs	1929	,,	250,000	500
18	Holden & Brook	1929	Electric	250,000	500
19	,,	1929	,,	250,000	500
20	,,	1929	,,	250,000	500

SCHEDULE No. 5.—TURBO-ALTERNATORS.—PLANT INSTALLED—RIVERSIDE POWER STATION.

Station No. of Turbo-Generator	Manufacturer	In Commission	Rating K.W.	Speed R.P.M.	Consumption in lbs. per K.W. at full load	Surface Condenser Maker	Air Pump		Condenser Extraction Pump		Generator (with exciter) 6,600 volts, 50 cycles	
							Maker	Type	Maker	Type	K.V.A.	Air Cooling System
1	A.E.G., Berlin	April 1913	2,000	1,500	14.1	A E.G., 1913	A.E.G.	Reciprocating Motor Driven	A.E.G.	Centrifugal Motor Driven	2,500	None.
2	do.	do.	2,000	1,500	14.1	do.	do.	do.	do.	do.	2,500	do.
4	G.E.C., U.S.A.	Nov. 1921	10,000	1,500	12.85	A.E.G. 1915	Hick Hargreaves	Ejector	Hick Hargreaves	do.	12,500	Carrier Air Filter
5	do.	Autumn 1917	10,000	1,500	12.85	Worthington U.S.A.	Worthington	Hydraulic Vacuum pump	Worthington	do.	12,500	Heenan & Frounde
6	Fraser & Chalmer	1918	5,000	3,000	13.	Worthington England	do.	do.	do.	do.	6,250	do.
7	C. A. Parsons	1920	10,000	1,500	11.9	Parsons	Parsons	Enclosed Edwards Motor Driven Ejector	Drysdale & Co.		12,500	Parsons Spray Filter
8	G.E.C., U.S.A.	March 1921	18,000	1,500	11.95	Worthington U.S.A.	Worthington	Hydraulic Vacuum Turbine driven ejector	Worthington	Centrifugal Motor Driven	22,500	G.E.C. enclosed circuit
9	do.	Aug. 1921	18,000	1,500	11.95	do.	do.	do.	do.	do.	22,500	do.
10	Metropolitan Vickers	Oct. 1923	20,000	1,500	11.31	Metro-Vickers	Hick Briguet	Ejectors	Metro-Vickers	do.	25,000	Enclosed circuit
11	C. A. Parsons	Nov. 1923	20,000	1,500	11.35	Hick Hargreaves	Hick Hargreaves	Ejectors	Hick Hargreaves	do.	25,000	do.
12*	Metropolitan-Vickers	May 1923	3,000	3,000	20	do.	do.	Ejectors	do.	do.	3,750	do.
13*	do.	Sept. 1923	3,000	3,000	20	do.	do.	do.	do.	do.	3,750	do.
14	do.	1929	20,000	3,000	9.52	Metro-Vickers	Metro-Vickers	Ejectors	Metro-Vickers	do.	25,000	do.
15	do.	1929	20,000	3,000	9.52	do.	do.	do.	do.	do.	25,000	do.

*House set.

ROTARY CONVERTERS AND MOTOR CONVERTER.

Description	Manufacturer	Voltage	Rating k.w.	Date Installed
Rotary Converter No. 1	Metro-Vickers	D.C. 440/450	750	1923
do. ,, 2	do.	do.	,,	,,
do. ,, 3	do.	do.	,,	,,
Motor Converter	B. T. H.	do.	,,	1929

One D. C. Switch Board consisting of 16 Panels containing the following circuits :—

5	Circuits of	2,000	amps.	2	Circuits of	300	amps.	Installed 1929
4	,,	,, 500	,,	4	,,	,, 250	,,	
8	,,	,, 450	,,	4	,,	,, 200	,,	

SCHEDULE No. 6.—CIRCULATING PUMPS.

(All vertical spindle centrifugal motor driven)

Local	Maker	In Commission	MOTORS		CAPACITY		
			Maker	B.H.P.	Diameter	Imp. Galls. per min.	Total head ft.
4	Mather & Platt	1917	Mather &	420	27″	20,000	50
5	do.	1917	Platt	420	27″	20,000	
6	Worthington, U.S.A.	1921	G. E. C.	550	36″	35,000 (U.S.)	33
7	do.	1921	do.	550	36″	35,000	33
8	W. H. Allen	1923	Brush Motor	350	32″	20,000	34
9	do.	1923	do.	350	32″	20,000	34
10	do.	1923	do.	350	32″	20,000	34
11	do.	1923	do.	350	32″	20,000	34
12	do.	1928	do.	350	32″	20,000	34
13	do.	1929	Lancashire Dynamo and	350	32″	20,000	34
14	do.	1929	Motor Coy.	350	32″	20,000	34
15	do.	1929	Brush Motor	350	32″	20,000	34
16	do.	1929	do.	350	32″	20,000	34

GENERAL SERVICE PUMPS.

1	Local	1914	Siemens	30	5″		
2	do.	1914	do.	30	5″		
3	do.	1918	Westinghouse	20	5″		
4	do.	1918	do.	20	5″		
6	do.	1918	do.	38	5″		
7	do.	1918	do.	38	5″		
8	Pulsometer Engineering	1924	Metro-Vickers	85	8″		
9	Company	1924	do.	85	8″		

OVERHEAD ELECTRIC TRAVELLING CRANES.

One 25-ton crane by Babcock & Wilcox. In commission 1913.
One 50-ton crane by Toledo Engineering Co., U.S.A. ,, ,, 1919.

AIR COMPRESSOR.

One "Ingersoll-Rand." Capacity 173 cu. ft. per minute.

ONE D. C. DYNAMO.

Reciprocating Steam Engine. Rating 50 k.w.

OIL FILTERS.

Four "Fox" Oil Filters.
Two "De Lavel" Oil Filters.

SPARE TRANSFORMERS.

Two 4,200 kva. suitable for either 5 or 7 Bank
Two 8,333 ,, ,, ,, ,, 8, 9, 10, 11, 14 or 15 Bank
One 1,333 ,, ,, ,, ,, I.T. 5 Bank.

SCHEDULE No. 7.

PARTICULARS OF TRANSFORMER EQUIPMENT.

For Alternators see report on Turbines.

Transformers	Manufacturer	Type	Rated Voltage	kva	Date Installed
No. 5 Bank	Westinghouse, U.S.A.	Water cooled Single Phase	13,700/6,600	4,200	Spring 1919
„ 7 Bank	do.	do.	13,700/6,600	4,200	26-2-20
„ 8 Bank	G.E.C., U.S.A.	Forced Oil Cooling Single Phase	13,700/6,600	8,333	Autumn 1922
„ 9 Bank	do.	do.	13,700/6,600	8,333	Aug. 1921
„ 10 Bank	do.	do.	13,700/6,600	8,333	13-11-23
„ 11 Bank	do.	do.	13,700/6,600	8,333	6-3-26
„ 14 Bank	do.	do.	13,700/6,600	8,333	not in commission
„ 15 Bank	do.	do.	13,700/6,600	8,333	do.
Interconnector No. 1	Westinghouse, U.S.A.	Water cooled Single Phase	13,700/6,600	2,000	27-2-20
„ „ 2	do.	do.	13,700/6,600	2,000	27-2-20
„ „ 3	G.E.C., U.S.A.	Forced Oil Cooling Single Phase	13,700/6,600	1,333	4-1-24
„ „ 4	do.	do.	13,700/6,600	1,333	10-3-24
„ „ 5	English Electric	do.	13,700/6,600	1,333	not completed
House Service No. 1	G.E.C., U.S.A.	Oil Cooled Three Phase	6,600/360	940	1912
„ „ „ 2	do.	do.	6,600/360	940	1914
„ „ „ 3	do.	do.	6,600/360	940	1914
„ „ „ 4	Berry	Water cooled Single Phase	22,000/202	500	5-3-20
„ „ „ 5	do.	do.	22,000/202	500	5-3-20
„ „ „ 6	G.E.C., U.S.A.	Oil Cooled Three Phase	6,600/350	940	6-9-23
„ „ „ 7	do.	do.	6,600/350	940	2-2-24
„ „ „ 9	do.	do.	6,600/350	940	3-4-24
„ „ „ 9	do.	do.	6,600/350	526	1-2-24
„ „ „ 10	do.	do.	6,600/350	625	22-1-24
6,600 volt Earthing Transformer	Metro-Vickers	Oil Cooled	6,300	800 amps. Short circuit	11-5-23
Rotary Converter Trans. No. 1	do.	Oil Cooled 3/6 Phase	6,600 + or—6%	825 kva	27-9-22
„ „ „ „ 2	do.	do.	do.	825	27-9-22
„ „ „ „ 3	do.	do.	do.	825	27-9-22

SCHEDULE No. 8.

PARTICULARS OF MAIN ELECTRICAL EQUIPMENT.

Switchgear—6,500 volt Switch House.

Oil Circuit Breakers	Type	Manufacturer	Voltage	Amps.	Date Installed
No. 8	F.FormH.6	G. E. C., U. S. A.	15,000	300	1921
7	„	„	15,000	500	„
2	„	„	15,000	800	„
2	„	„	15,000	2,000	„

All switches installed 1921, and have overload and balance protection except one bus paralleling switch.

Switchgear—22,000 volt Switch House.

		Section 1.			
No. 7	H.6	G.E.C., U.S.A.	35,000	500	1919
4	H.6	„	35,000	800	„
2	0. H. 25	B. T. H.	35,000	500	1924
2	H.6	G.E.C., U.S.A.	35,000	800	„
		Section 2.			
No. 4	H.6	G.E.C., U.S.A.	35,000	500	1924
1	0. H. 25	B. T. H.	35,000	800	„
2	0. H. 25	„	35,000	500	„
2	H.6	G.E.C., U.S.A.	35,000	800	„
		Section 3.			
No. 5	H.6	G.E.C., U.S.A.	35,000	500	1924
3	H.6	„	35,000	800	„
1	0. H. 25	B. T. H.	35,000	500	„
		Section 4.			
No. 4	H.6	G.E.C., U.S.A.	35,000	500	1924
3	0. H. 25	B. T. H.	35,000	500	„
1	H.6	G.E.C., U.S.A.	35,000	800	„
2	0. H. 25	B. T. H.	35,000	800	„
		Section 5.			
No. 4	H.6	G.E.C., U.S.A.	35,000	500	1924
3	0. H. 25	B. T. H.	35,000	800	„
		Section 6.			
No. 2	0. H. 25	B. T. H.	35,000	500	1927
3	0. H. 25	B. T. H.	35,000	800	„
		Section 7.			
No. 6	0. H. 25	B. T. H.	35,000	500	1927
3	0. H. 25	B. T. H.	35,000	800	„

The four feeders in Section 1 and one feeder in Section 5 have split conductor protection and are fitted with split conductor switches.

Switches 1 to 7, with the exception of the above, all feeders and generators have :—

Balance leakage and overload protection
Reactors „ „ „ „
Interconnectors balance and overload protection

Bus section couplers and bus paralleling switches no protection.

Each section and auxiliary bus bar is connected to reactor tie bus through three 350 amps. reactors. Section 1 and auxiliary bus bar are equipped with aluminium lighting arrestors, sections 2 to 7 with oxide film arrestors.

Correction

Attention is called to an error in our April issue, on page 7, in the advertisement of The General Electric Co., Ltd. The caption under the Circuit Breaker Switching Station was inaccurately titled : " A C.E.A. Circuit Breaken Switehing Station." It should have appeared with the title : " A G.E.C. Oil Circuit Breaker Switching Station."

Reconstruction of Tokyo-Yokohama District

[*The following is taken from an article by Mr. J. H. Ehlers and issued by the Department of Commerce.*]

Waterworks

In 1913 Tokyo undertook the construction of a project designed to increase its water supply from 6,000,000 cubic feet a day to 18,000,000, at a total estimated expenditure of Y.47,500,000. The plan involved the creation of a new storage reservoir of 440,000,000 feet at Murayama, about 25 miles northwest of the city, into which the water is brought by an aqueduct from the Tama River. The earthquake interfered with the final completion of the project and caused much damage to the work. The sum of Y.10,000,000 was budgeted for waterworks construction after the earthquake—Y.5,300,000 being for repairs and Y.4,700,000 for extension and completion of the original program. The National Government provided a subsidy of Y.2,500,000.

The restoration work consists in repairs to the damaged water pipes in the city of Tokyo, the reconstruction of Yodo-bashi filter beds, and the construction of a viaduct. This work has been completed.

The extension program involved work on the dam and reservoir at Murayama and the laying of a new water main between Wadabori and Shinjiku, a Tokyo suburb. The work on the reservoir is completed and the pipe laying about 75 per cent. completed.

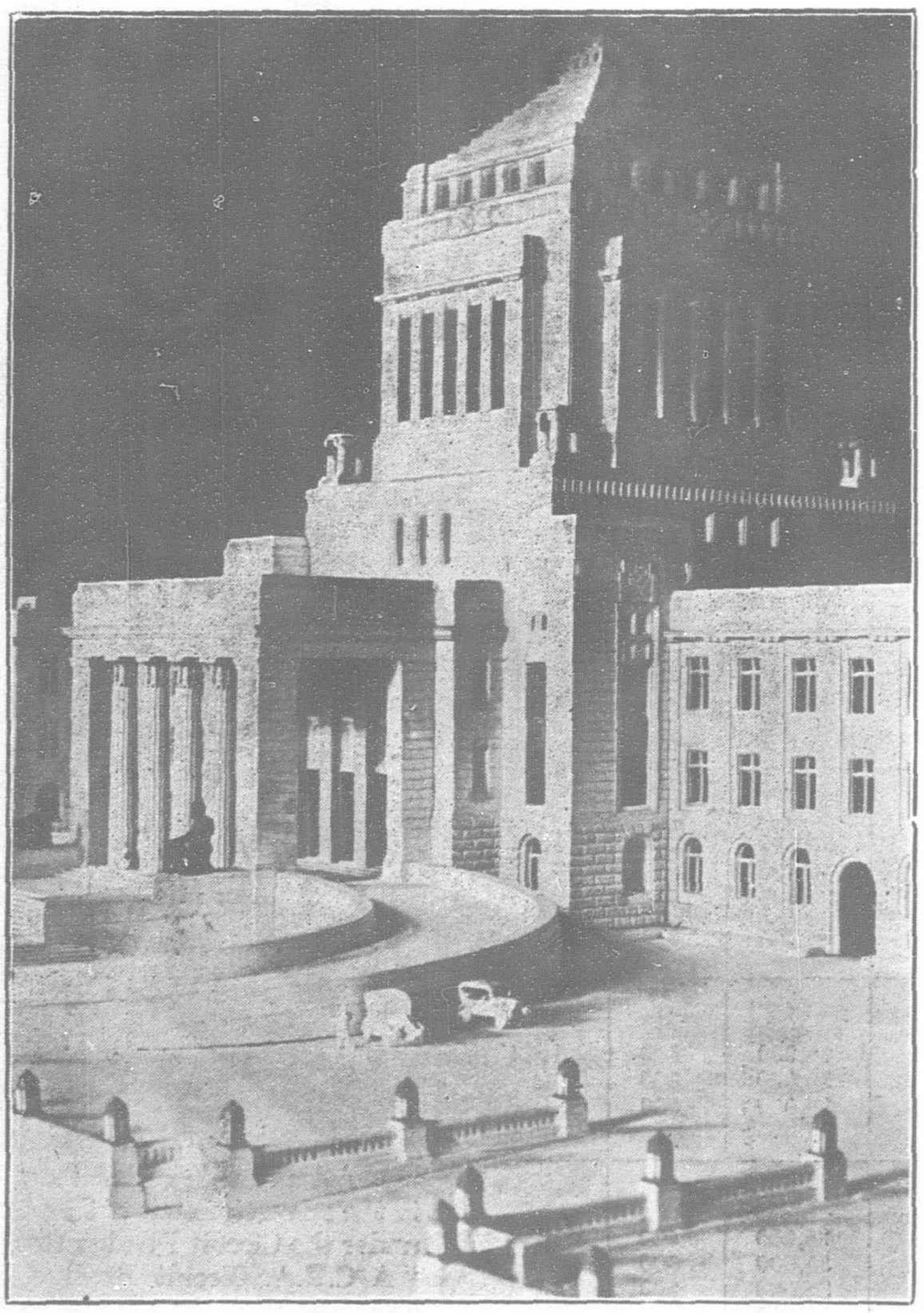
Yokohama has a program for waterworks repairs and construction involving Y.3,000,000 for the repair of pipes and the reconstruction of filter beds; 4 per cent. of this work has been completed.

Sewer Systems

Sewer systems are a distinct novelty in Japanese economy. Open or covered drains usually provide for storm water, and individual catch basins are used for sewerage.

For several decades some sewer-construction work has been carried on in the more important cities. Ten or more cities are now partially equipped with sewer systems. In 1911 the Tokyo authorities started a sewer-construction project. From 1911 to 1923 work consisted of the construction of sewers in Asakusa, Shitaya, and Kanda wards, as well as some emergency storm-system construction. This part of the work was practically completed just prior to the earthquake of 1923. In 1920 the second part of the program was commenced, consisting of sewer construction in the important districts of Nihonbashi, Kyobashi, and Marunouchi, in the heart of Tokyo. This work was severely damaged by the earthquake.

The reconstruction budget contained an item of Y.390,000 for repairs, and another of Y.43,110,000 for improvements and extensions. A subsidy of Y.21,750,000 was granted to the city by the National Government.



The New Diet Building.

Of the repair work, the laying of pipe and the restoration of one sewerage disposal plant have been completed.

The item of Y.43,000,000 for improvement includes (1) the completion of the first part of the original program by finishing one sewerage disposal plant and storm sewers in Asakusa ward; (2) continuing the work of the second part, comprising the installation of piping in Maruyama and Shiba, central sections of the city; and (3) starting the third part, consisting of construction of the Honjo and Fukugawa sewerage disposal plants in the crowded industrial sections, and much pipe laying. The first part of the program has been completed, also 70 per cent. of the second part and 40 per cent. of the third part. The sum of Y.23,150,000 has already been expended on the entire program, indicating that the work is 53 per cent. finished.

Yokohama contemplates the expenditure of Y.1,250,000 for sewer repairs and construction, one-half of which is furnished by the National Government as a subsidy. The sum of Y.503,000 has already been expended, indicating a 40 per cent. completion of the work.

Refuse Disposal

The mode of collecting refuse in Tokyo is quite primitive. City scavangers remove the refuse from the householders' bins at intervals and carry it to lands being reclaimed, or to fields for burning.

In the new reconstruction program 27 public dumps and four disposal ditches are to be provided, at a cost of Y.1,850,000 of which Y.462,600 comes from the National Government as a subsidy. Seven of the 27 new dumps have already been provided and others are being prepared.

Social Welfare

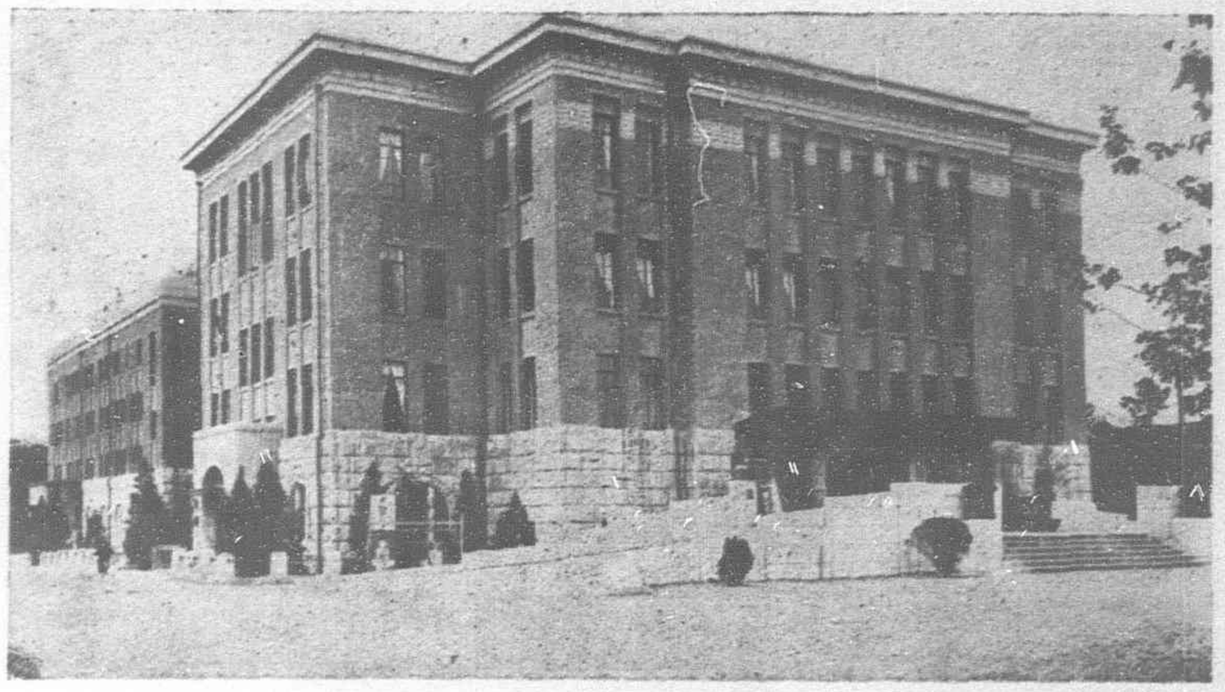
A number of social-welfare institutions are being planned. Several children's health-consulting offices, a women's workhouse, various public eating houses and boarding houses, pawnshops, and public bathhouses are included in the Tokyo program, to be carried out at a total cost of Y.4,525,000 of which the National Government provided a subsidy of Y.1,243,000. Over Y.1,000,000 has already been expended, about 23 per cent. of the work being completed.

In Yokohama Y.750,000 including a subsidy of Y.210,000 from the National Government, is to be expended on the construction of social-welfare institutions similar to those in Tokyo. Thirty-seven per cent. of the work has been completed at an expenditure of Y.282,000.

Miscellaneous Activities

Among other activities of importance in connection with the earthquake reconstruction program is a geological survey. In Tokyo and Yokohama 650 borings out of a proposed total of 850 have been completed.

The Yusen Apartment House in Marunouchi, Tokyo.



The Hall of Y.M.C.A. at the Meiji Shrine out Garden, Tokyo.

Many of the principal streets and roads are being planted with trees. It is planned to set out more than 24,000 trees, to replace those which were destroyed in the earthquake and to beautify new roads. A considerable acreage has been set aside as a nursery to provide the necessary trees and shrubs.

Electric Supply

The earthquake destroyed the buildings of the municipal electric bureau, nearly 800 cars, several car sheds, 18 power stations and transformer stations, as well as over nine miles of electric tramways and 41 miles of electric wires. The sum of Y.40,500,000 is designated as a reconstruction fund for these items, of which Y.37,980,000 is for tramways and Y.2,520,000 for electric supply. No subsidy for this work is provided by the National Government, but any loans obtained by the municipality from foreign countries for this purpose are to be guaranteed by the National Government. Over 1,000 new tram cars have been provided, and several car sheds have been reconstructed. In connection with the power and light supply of the city two buildings have been reconstructed and about 20 miles of electric wiring have been newly placed. Work on power equipment, amounting to 15,000 horse-power, has been finished. A sum of Y.17,980,000 has already been expended on the project, or 42 per cent. of the entire amount.

Yokohama plans to spend Y.8,500,000 on the repair of electric works. The sum of Y.3,555,000 or 41 per cent. has already been expended. Amounts in addition to the above-mentioned sums are being expended by the municipalities, but these are not designated reconstruction expenditures.

Zoning

In order to provide more economic functioning of the cities of Tokyo and Yokohama an attempt has been made to divide these cities into zones for residential, commercial, and industrial uses. This has been done for the entire area of both cities, including the parts not in the reconstruction area.

Of the total area of 24,100,000 tsubo (19,800 acres), 10,000 acres, or 50.5 per cent. is residential; 5,850 acres, or 29.6 per cent. is commercial; 2,900 acres, or 14.5 per cent. is industrial; and 1,050 acres, or 5.4 per cent. is unclassified.

In addition to the city of Tokyo proper certain areas of the adjoining suburbs, which will ultimately be included in Tokyo city, are applying zoning regulations, so that a grand total of 54,400 acres is zoned, of which 43.4 per cent. is allotted for residential purposes; 16.2 per cent. for commercial uses, and 37.1 per cent. for industrial, while 3.3 per cent. remains unclassified.

In Yokohama, of a total area of 9,400 acres an area of 5,450 acres, or 58 per cent. is classified as residential; 2,350 acres, or 25.2 per cent. as commercial; and 1,600 acres, or 16.8 per cent. as industrial.

In the whole zoning system much latitude is allowed. The Japanese custom of living behind small shops means that numbers of business houses and residences will be combined.

It is the intention of the authorities to allow small business enterprises, such as retail stores, to be built in the sections designated as residential. It would be impossible to keep retail business completely out of residential sections, but severe limitations will be imposed.

Principal streets throughout the residential zone are designated as commercial streets. The zoning system at present is simply a start on what will later take care of the demands of the city as it becomes more completely modernized.

In Japan residences are built behind walls, and often the finest residences are to be found in a neighborhood with shabby outside appearance. The greater part of the residences are on narrow streets, many of which are barely wide enough for motor traffic, and on many streets motor vehicles are not allowed.

Practically no street has a name. A particular house is designated by its ward, district, subdistrict, house number, and often by the house subnumber. There are no street signs available. Maps are posted at various sections and, when located, assist in finding houses.

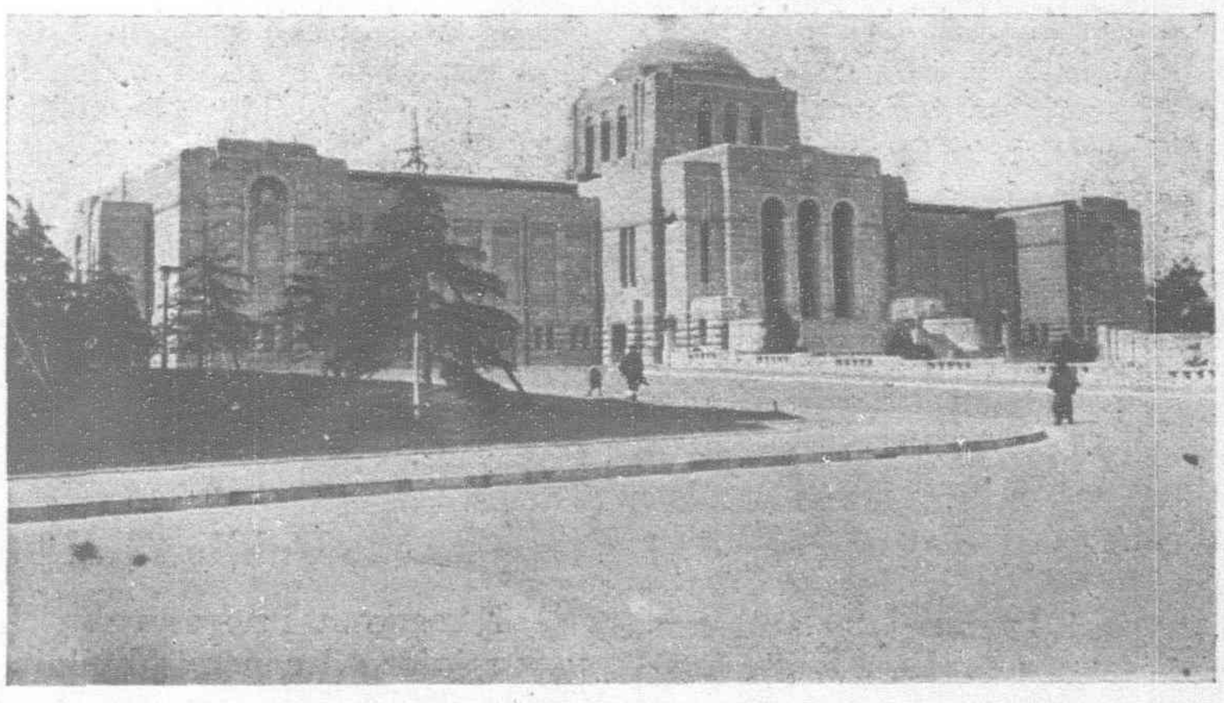
The city of Tokyo is actually a group of towns, each having its own division into sections. With the development of the western type of organization and an increase of international business the city as a whole has developed a financial center, an importing business house center, and an industrial district.

Fireproof Building Zones

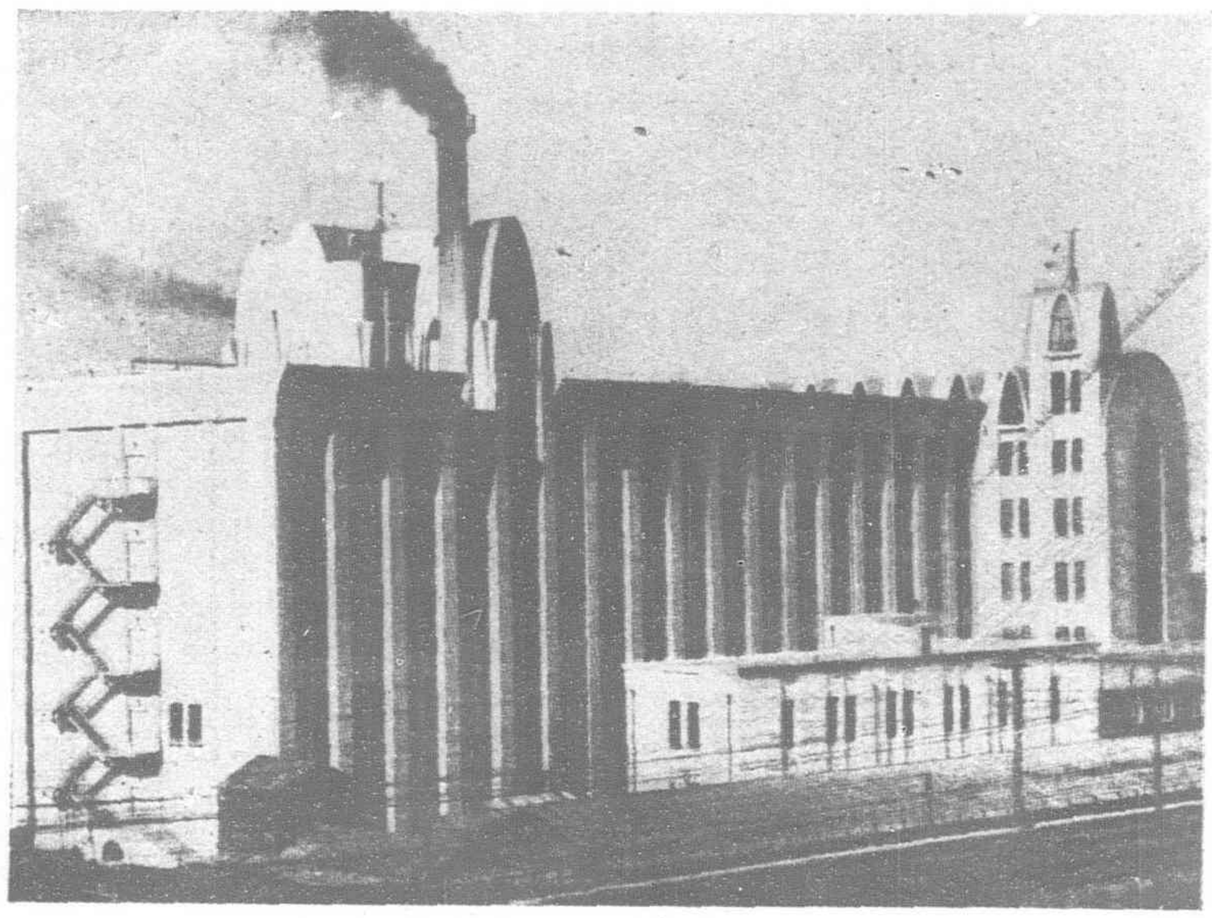
For the purpose of making Tokyo secure against sweeping conflagrations it was necessary to create certain fireproof districts and also isolated fireproof lines along certain main thoroughfares in order to prevent the spread of fire across such lines. In Tokyo there are two classes of fireproof constructions. Class "A" consists of entirely fireproof buildings and Class "B" of buildings with fireproof exterior.

In Yokohama only Class "A" fireproof construction has been designated. A subsidy of Y.20,000,000 has been allotted by the National Government, through the Reconstruction Bureau, for fireproof-building construction. Approximately Y.16,000,000 will be used as subsidies to building owners in Tokyo and Y.4,000,000 to those in Yokohama. The following gives a general indication of the amounts of subsidy to be awarded:

1. 50 yen per tsubo will be awarded on houses for an entire fireproof construction.



The Gallery in the Outer Garden of Meiji Shrine, Tokyo.



Tokyo Central Telegraph Office Building.

2. 40 yen per tsubo will be awarded to houses having a fireproof exterior and floors.

3. Theaters, public halls, hotels, garages, department stores and similar structures will receive subsidies of 20 to 30 yen for fireproof construction.

4. Slightly higher subsidies will be given for buildings having a height of more than 65 feet.

These subsidies will be given to private owners who construct buildings. The subsidy was designed to represent half of the difference in the cost of the construction of a fireproof building, as compared with the ordinary building which would otherwise be permitted in any given locality.

Subway Construction

The new Tokyo plans the construction of subway systems. The rapid growth and the restrictions upon high buildings because of earthquake regulations require an expansion of the city limits. Rapid transit is fast becoming a necessity. The present elevated lines of the National Goverament railways afford very satisfactory transportation, but they are rapidly becoming inadequate to meet the demands of many sections. Land values are so high that construction of surface rapid-transit systems is prohibitive. The alternative is underground construction. There has been much discussion as to the advisability of subway construction in this territory, owing to the frequency and severity of earthquakes, but it is believed that it can be safely undertaken.

A part of the subways proposed will be operated by a private company and the remainder by the municipality. The Tokyo Underground Railway Co., with a capital of Y.20,000,000 obtained the concession for constructing and operating a considerable length of subways. The first section to be built has a length of 1.5 miles and runs from the Uyeno railway station to Asakusa Park, in the crowded poorer districts of Tokyo. The contract for its construction was let to the Okura Doboku, a large local contracting firm, which is now bringing this section to completion. This work was undertaken at a cost of about Y.2,000,000 while the total expenditure of the company, including the cost of equipment, is said to be Y.3,500,000. Traffic was opened on this section in December, 1927.

The work was done in open cut and is of concrete and steel-frame construction. All the materials were supplied locally. Motors for the cars as well as the automatic turnstiles at the stations are of American make. The cars were made locally. Some American steam-hammer pile drivers were used in the construction. Cement guns of European manufacture were used, while the other machinery was supplied locally.

The contract for an additional seetion has been let to another local contracting firm. This section runs from Uyeno station, the terminus of the previous section, to Manseibashi, Kanda, in the central part of the city. This section is 1.3 miles long and construction is now in progress.

Plans for the municipal subway program have been drawn up, but no construction or financing operations have yet been undertaken or definitely arranged for. It is quite probable that owing to unfavorable financial conditions the construction of this subway system will be postponed for some time. The municipality's plans call for the ultimate construction of 41 miles of electrically operated subways, at a total cost of Y.187,000,000. A part of this will be elevated track, as required by the topography. The plan allows 13 years for the completion of the work. Three hundred thousand yen has been made available for surveys, which are expected to be completed during 1929.

Government Buildings in Tokyo

Many new Government buildings are planned for the new city of Tokyo. The construction of these will be carried out under the direction of the various governmental departments concerned. Outstanding among them will be the new Imperial Diet building. This structure was commenced in 1918 and will not be completed until about 1933, although the framework was entirely completed in April, 1927. It is a heavy steel-frame structure with reinforced concrete walls interior and exterior, faced with granite. It is three stories in height, and is surmounted by a tower 216 feet above the ground. This building will be headquarters for the National Government legislative bodies, and will be by far the most imposing building in Japan. It has a length of 675 feet and a width of 285 feet, a total floor space of 540,000 square feet, and is earthquake proof.

The building rests on 4,000 concrete piles 30 feet long. The structural steel has a total weight of 9,000 tons and was furnished by the Yawata Steel Works. The materials for the entire building are of local origin, and the construction and design are entirely in the hands of local engineers and builders. Construction is carried on from year to year as appropriations are made available. It is estimated that the total cost will be Y.20,000,000. This building was designed and construction commenced before the earthquake of 1923. After that occurrence, the design was changed somewhat. Knee braces were provided on all columns at floors, and heavy concrete partition walls were specified. All the steelwork is incased in reinforced concrete. The whole project is a good example of the increasing self-sufficiency of Japan in the matter of heavy-building design and construction.

Plans have also been drawn up for a group of buildings to house all the ministries of the Government. New buildings will be provided in this group for the Foreign Office ; Finance Department ; the Army ; Department of Agriculture and Forestry ; Department of Commerce and Industry ; and Department of Communications ; for a courthouse, a central library, and an auditorium ; and for other institutions or official bodies. This entire program will be carried out under the jurisdiction of the engineering bureau of the Japanese Government's Ministry of Finance. The total estimated expenditure of this group of buildings is Y.100,000,000. It is quite likely, owing to the ambitious nature of this program, that actual construction work will be delayed for some years.

The new municipal building is planned to cost about Y.12,000,000; Y.4,000,000 of which will be required to purchase the four acres of land required. The building will have seven stories and will be surmounted by a tower rising 270 feet above the ground. The structure will be of structural steel and reinforced concrete and the tower will necessitate exceptionally heavy construction to provide for safety against earthquakes. It is proposed to commence the construction of this building in the autumn of 1928 in commemoration of the coronation which is to take place at that time. The plans for the building have been recently completed and it is expected that tenders will be received within a few months, while construction will require at least six years.

It is estimated that the total cost of Government buildings in Tokyo, either now under construction or whose construction is to be undertaken within the next five years, will be in the neighborhood of Y.150,000,000. The progress of this ambitious building program will depend entirely on the financial status of the National Government.

Public Buildings in Yokohama

Kanagawa Prefecture in Yokohama has under construction a new reinforced concrete building which will cost over Y.3,000,000. This building has a light riveted structural frame embedded in the concrete to give additional strength and to provide greater resistance

to earthquake shocks. It is five stories in height with a tower rising 70 feet above the main roof. The construction work is under the supervision of the engineering department of the Kanagawa prefectural office. The Imperial Government Railways plan to construct, in the near future, a new main railway station in Yokohama on a site somewhat removed from the present Yokohama station, and a large, four-storey, concrete structure with brick facing has been built for the National Government Department of Agriculture and Forestry for use as a silk-conditioning house.

Although the amounts estimated for Japan's buildings are very large, the construction of these forms an essential part of the Japanese Government's program to make of Tokyo a model imperial capital, built upon the most approved and most advanced western lines.

Harbor Reconstruction and Development

In addition to the Government building program various public works are being constructed. The Tokyo municipality has under consideration a proposal calling for the ultimate expenditure of Y.31,000,000 for harbor work, which will include a considerable amount of reclamation and dredging, as well as the construction of warehouses and railroads on the reclaimed lands. Important improvements are being made in connection with the Tokyo station and other railway stations in the city by the Railway Department.

In Yokohama the public work most deserving of attention is the harbor reconstruction and development. Yokohama harbor was in the area of the severest shocks during the earthquake of 1923 and enormous damage was done. The two factors which entered into the reconstruction work above all others were strength and speed of reconstruction. The latter point was very essential to the maintenance of Yokohama's position as a port. The breakwater repairs were completed in six months from the time of commencing reconstruction, the quay walls and the barge wharves in 17 months, and the landing pier in two years. The port is now proceeding on the enlargement of the harbor, the program to be completed about 1930.

The Ministry of Home Affairs has drawn up plans for further development of the harbor which will be put into execution as funds become available and as shipping requires. These plans include the reclamation of 870 acres along the water front and the construction of over five miles of quay walls. The construction of two outer breakwater is proposed.

Private Building Reconstruction

One of the most important phases of the entire reconstruction work, and the phase about which little information is available, is that of private building. Following the earthquake destruction probably 250,000 temporary structures were erected in Tokyo and Yokohama. These were light wooden structures designed for temporary occupancy only. In connection with the land readjustment program it was necessary to order the removal of 200,000 houses in Tokyo and 20,000 in Yokohama. It is obvious that such an enormous task would require years for completion, and, pending readjustment of property boundary lines, the erection of permanent buildings would necessarily be delayed in the districts which were most badly damaged. Moreover, the financial circumstances of prospective builders did not warrant undertaking permanent construction. Hence all parties were convinced that houses built for temporary occupancy should be allowed to remain standing for a much longer period of time than had been anticipated.

The original understanding was that all structures were to be removed within five years. This was proved to be utterly impracticable, and ordinances have been issued to solve the problem. All temporary structures will be allowed to remain five years longer than originally stipulated. Certain of the structures designated as class "A" which satisfy certain municipal regulations will be allowed to remain until 1938. The number of these is placed at about 30,000. Such temporary public meeting houses, factories, hotels, theaters, hospitals, and schools as are designated by the Home Ministry will be allowed to remain until 1933. All barracks, as temporary buildings are called, constructed of non-inflammable materials, will be allowed to remain permanently.

It is extremely difficult to estimate what percentage of the temporary structures will be allowed to remain for their natural life. Some estimate that as high as 80 or 90 per cent. will remain for such a length of time. The proportion will depend upon the ability of property owners to finance new construction. Probably 75 per cent. is a fair estimate of the number that will be allowed to remain for approximately their natural life, although if any great wave of prosperity reaches the community it is likely that a considerably smaller percentage will remain. The cost of construction of these barracks is hard to estimate. A general survey of average costs and of average sizes seems to indicate that Y.900 per house probably represents a possible average value, giving a total value of about Y.180,000,000 expended in the construction of temporary buildings in the city of Tokyo. Of this we may consider Y.135,000,000 to represent buildings which will remain as part of the reconstructed city, the remaining costs being written off as emergency earthquake expenditures.

Several of the buildings now in course of erection or already completed merit special mention. In general it may be said that structures intended for the use of large commercial interests are fireproof and earthquake proof. The Tokyo building code requires that these buildings be designed on the assumption that earthquake forces acting horizontally may be equal to one-tenth of the weight of the building. The consideration of such forces has led to the construction of some notable buildings.

Foremost among these may be mentioned the new Mitsui Bank building. This building will have the world's largest floor devoted exclusively to banking. The structure was designed by an American architectural firm, and is being constructed by a large American contracting firm. The total cost is expected to be nearly Y.20,000,000.

The height of the building is limited by the local building code to 100 feet. It has a heavy structural steel frame with many novel features to add to its security against earthquakes. The weight of steel per square foot of floor space is nearly 45 pounds. A similar structure in the United States would have about 20 pounds of steel per square foot. In addition to the heavy steel construction the walls, both exterior and interior, are of heavy reinforced concrete. The exterior is of granite, backed by concrete. The structure contains 10,000 tons of structural steel, of which 2,000 tons were fabricated in the United States and the remainder in Japan. The building rests on a heavy reinforced concrete mat four feet thick, having an area of 50,000 square feet.

This is an outstanding piece of construction work. An endeavor was made to teach American construction methods to Japanese contractors and workers. Some types of machinery which had been heretofore almost unknown in Japanese construction was imported for the work. It was found difficult to persuade local contractors to use some of it. Stone-cutting machinery was supplied to stoneyards, but the local contractors insisted on proceeding with hand cutting. New machines were furnished to some of the structural shops and their use proved successful. Despite difficulties which have arisen, the work is an excellent example of American construction in the Far East and is worthy of study both as to its structural features and as to the methods by which Japanese workers adapted themselves to American building usage. The result is an imposing structure erected in much less time than is usual in this country.

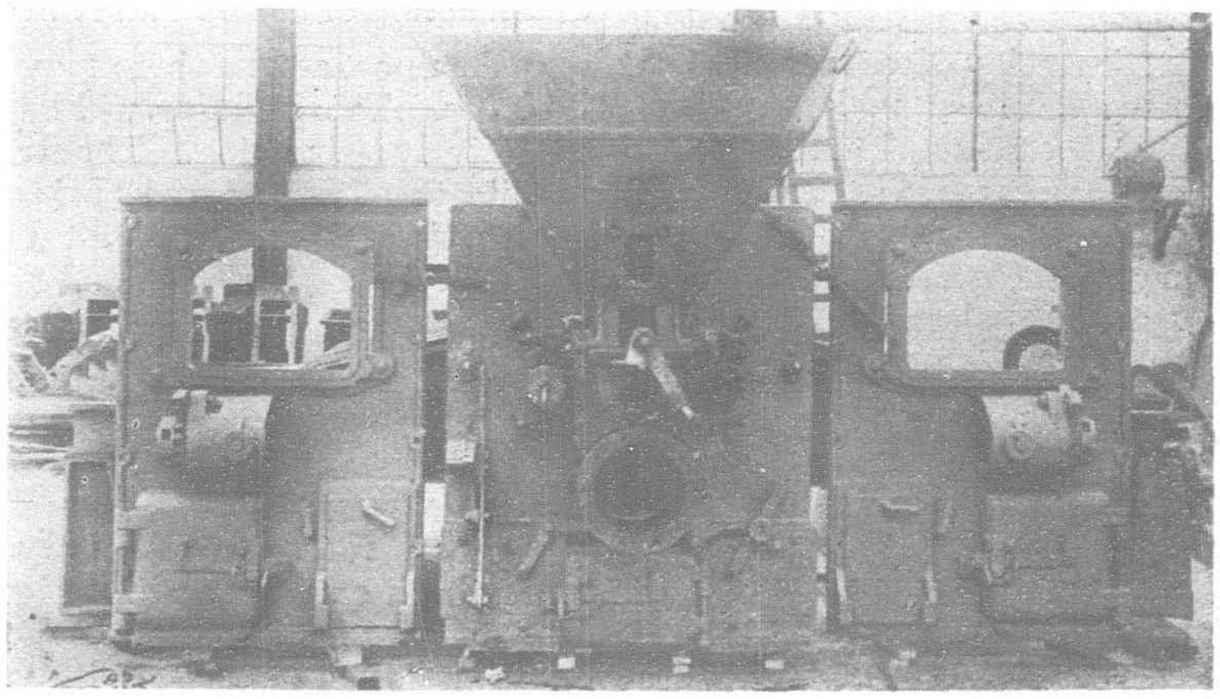
The Yaesu Building, now nearing completion in the central business district of Tokyo, is characteristic of a type of construction which is gaining in favor in that district and which is well adapted to peculiar local conditions. This building contains a light structural frame which is inclosed in reinforced concrete. Past experience has revealed many defects in concrete-building construction. In some cases columns were not exactly vertical and dangerous eccentricity of load occurred. The use of this very light riveted framework assures correct alignment and assists in preventing failure through local defects in the concrete work. In some cases these light frames are designed to carry a portion of the weight; in other cases to carry the extra earthquake forces; and in other cases no forces at all, the reinforced concrete being designed to carry all loads and forces.

A large library building, recently completed for Tokyo Imperial University, makes use of similar construction.

Mechanical Stoking for Smaller Water Tube Boilers

Progress in the Far East with an Interesting Design

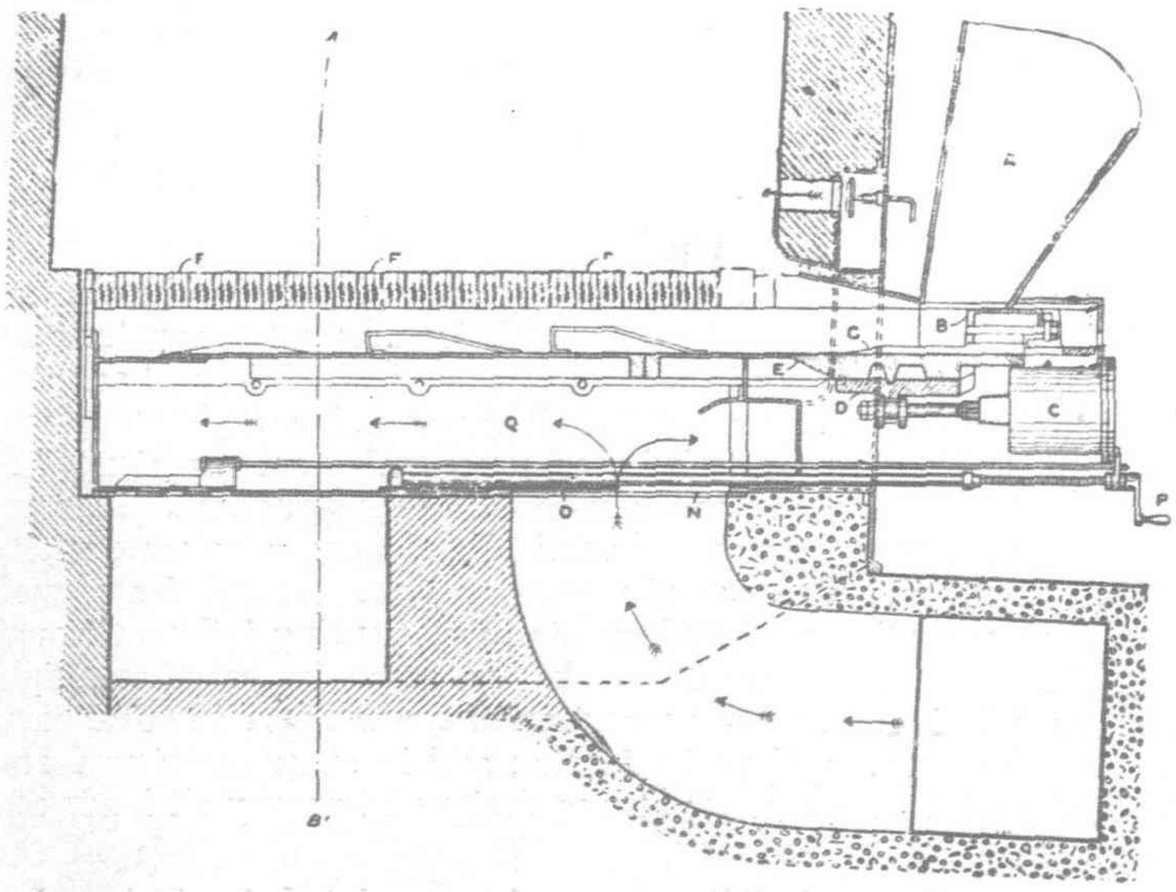
BOTH for industrial establishments and sea-going conditions the water tube boiler is now being more and more employed, especially in conjunction with "pass-out" engines and turbines for process and low pressure "boiling" steam, and in this connection interesting developments are taking place with the "Underfeed Type E" mechanical stoker. Also the stoker is now beginning to be extensively used for marine work, and 26 vessels of the Dutch Steamship Company, the Koninklynke Paketvaart Maatschappi of Amsterdam are now operating in the Far East with these stokers, whilst a number of other vessels belonging to the same Company are being equipped. The vessels are all equipped with water tube boilers, and the "E" stoker is specially designed, equally for land and sea-going conditions, to operate smaller water tube boilers, burning say up to 2½ tons of coal per hour, a large number of industrial plants being at work.



Stoker in Course of Construction.

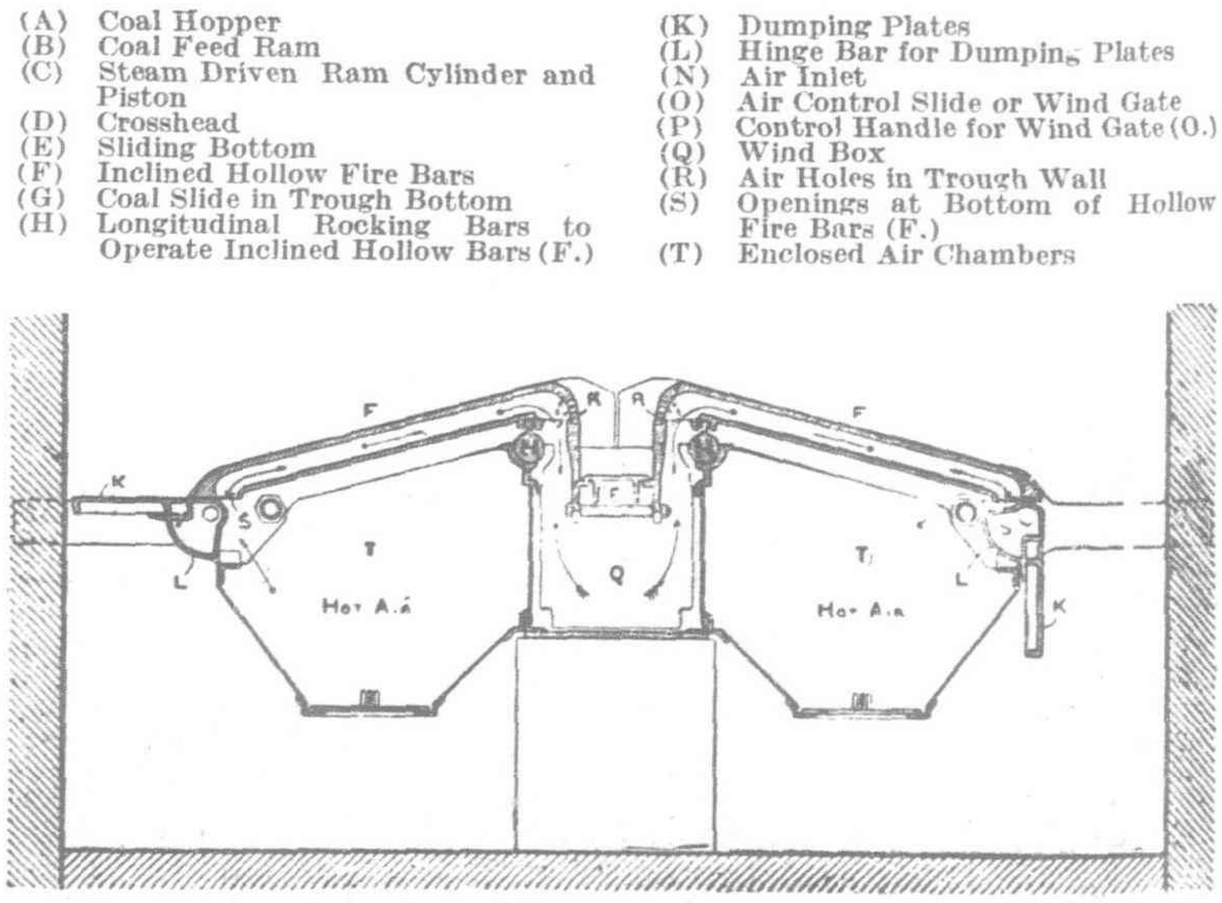
The design is that of a coking stoker, operating with a steam reciprocating ram, situated at the center underneath the hopper, this ram being adjustable in speed so as to deliver any desired amount of coal from 120-5,400 lbs per hour, thus allowing ample flexibility. The coal is merely thrown into the hopper as required and the ram then pushes it into a trough in front, situated between each side of the sloping grate bars, which are of extremely novel and ingenious design, hollow in construction, and having a reciprocating motion. The coal fills the trough and flows over along each side and down the bars, while at the top part coking commences, all the gases and vapours being driven off and burnt in the combustion chamber, the top part of which is constructed by the tubes of the boiler. The residual coked product then burns as it travels slowly down the inclined bars, aided by the slight reciprocating motion, the ash and clinker accumulating on the flat supporting arrangement shown, and being pulled out through the front of the stoker by means of firedoors at intervals. Also the operation is aided by means of a forced draught fan connected by trunking underneath with dampers under accurate control by means of levers in front of the stoker by the side of the steam driven ram.

The passage of the air is arranged on the most scientific principles, being partly discharged from the windbox underneath through a series of tuyeres or openings at the top of the inclined grate, directed through the trough. All the remainder however, passes down inside the hollow reciprocating bars, which are thereby cooled, and afterwards the hot air comes up between the bars in the ordinary way to burn the coked material, the net result being entirely smokeless combustion. Also of course a steady steam pressure is maintained, since cleaning out in the ordinary sense of the term is eliminated, while it may be pointed out that the amount of steam taken by the ram is approximately ¾ per cent. of the production of the boiler, and this, together with another ½ per cent. absorbed by the fan represents a figure less than ordinary mechanical draught with hand firing. Mostly these particular Dutch steamers are engaged in trading voyages in Chinese waters, and the conditions are very severe as regards variations in the quality of the coal available, but the results are excellent.



Longitudinal Section, Class "E" Stoker

(A) Coal Hopper
(B) Coal Feed Ram
(C) Steam Driven Ram Cylinder and Piston
(D) Crosshead
(E) Sliding Bottom
(F) Inclined Hollow Fire Bars
(G) Coal Slide in Trough Bottom
(H) Longitudinal Rocking Bars to Operate Inclined Hollow Bars (F.)
(K) Dumping Plates
(L) Hinge Bar for Dumping Plates
(N) Air Inlet
(O) Air Control Slide or Wind Gate
(P) Control Handle for Wind Gate (O.)
(Q) Wind Box
(R) Air Holes in Trough Wall
(S) Openings at Bottom of Hollow Fire Bars (F.)
(T) Enclosed Air Chambers



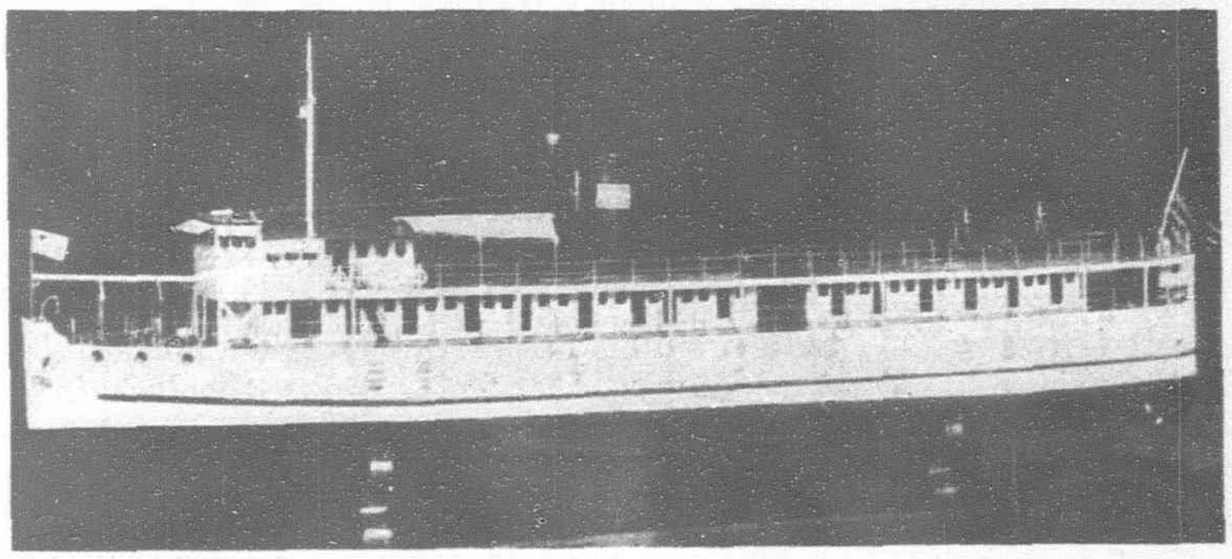
Transverse Section, Class "E" Stoker Through Line A-B Plate 3

Expansion of Yangtsze Rapid S.S. Company

By John Marshall

AT four-thirty on the morning of April fourth the *M/V I'Tu* bound for Chungking on her maiden trip left the China Merchants' Central Wharf, Shanghai, and slipped past river craft and ocean craft as the Whangpoo was traversed.

To that group of men interested in river shipping, and especially Upper River shipping, the departure of the *I'Tu* was more than an incident. To them this ship, built along new lines and the largest low-water river ship on the Yangtze to be powered with Diesels, was an experiment ; whether or no her maiden trip was a successful one was of vital interest to them. Hankow was reached in just sixty running hours, that being very good time. The ship worked excellently. Her bow cut the water as a knife would instead of piling it up in a great heap before her. The water resistance was down to a minimum for in addition, aft, instead of running the propellers in tunnels, the stern was cut away clean. Ichang was the next port of call, that city being just one thousand miles from the Sea, and marks the beginning of what is known as the Upper River.



Model of M/V "I'Chang"

It is this Upper River that is indeed a test for ship construction and ship endurance. The Lower and Middle Rivers are bad enough but it is the Upper River that personifies treachery. For, that three hundred and fifty miles from Ichang to Chungking is interspersed with fast moving water, eddies, rapids, and whirlpools. The places of outstanding danger change as the Great River rises or falls according to the freshets. Take for example one of the rapids known as the Hsin-tan. At low water only the ships with the greatest power can climb it without the aid of heaving. At the same level the Yeh-tan, another rapid, is most peaceful. But let us have a rise in the river level and the Yeh-tan madly rushes at a rate of from thirteen to fourteen knots an hour ; at the same time the Hsin-tan subsides and loses its ferociousness. The greatness of the strain that a river-ship goes through every time that she is compelled to heave a rapid might be more easily understood if a description of an actual " heaving " was given. I will take an excerpt from an article that I have prepared for an American periodical :

" Four miles above Kwei-chou is another famous rapid, the Yeh-tan. The river at this point is only one-half its normal width —due to a sturdy outcropping of rock on the right bank (the bank to the left going up river) and a delta of boulders which have pushed out into the river from a torrential stream on the left bank. At medium level the river backs up, causing a very swift flow of water through the gap. When the river is at low level, or at high level— the water then pours over the delta—, the current is about halved.

" I recall that it was drizzling as we stood below the rapid waiting for the *Mei Lu* to get over. After half an hour of trying, she had to heave. The current was approximately thirteen knots.....

" The *Mei Lu* now being over, the Captain signaled for full-speed and away we started through the foot of the rapid, on toward the turbulently boiling middle and upper sections. Our path lay close in towards the left bank of shingle and boulders, for we were taking advantage of the back wash. The ship's telegraph clanged in a jerky manner and emergency full-speed was asked for.

" While we were trying so valiantly to climb the rapid a howling and yelling commenced on the right bank where some two hundred coolies sat, squatted, or stood, watching. .....they were calling upon all the gods that we would not make it.....

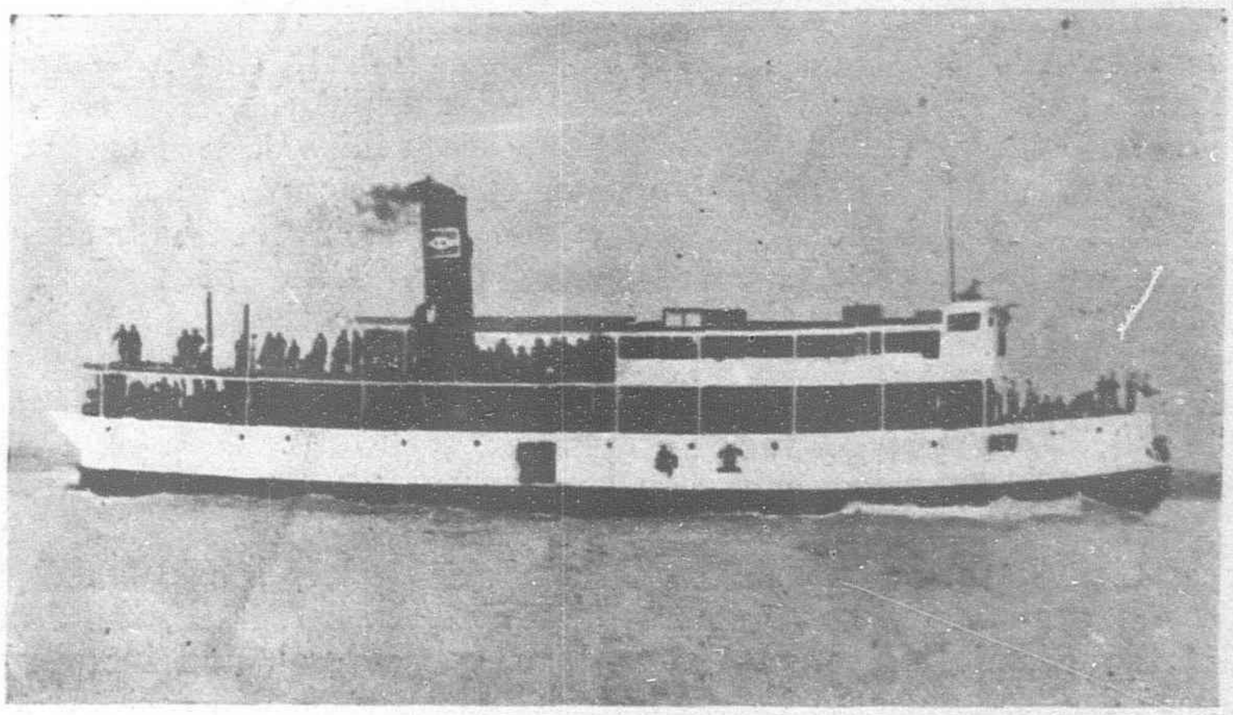
" By this time we had nearly reached the head of the rapid, a glassy inclined surface. This surface remained constant but its ingredient kept slipping swiftly past, suddenly becoming a foaming, bubbling, swirling rapid, as it broke its glassy form.

" We were still moving but at a laboriously slow rate. The critical point was reached. Now would determine whether or not we should have to haul over. The coolies on the shore were screaming in fear that they might lose. The crew was ordered forward in a hope that the additional weight would throw us over, for we were literally balancing on the crest of the rapid—where we remained for several minutes.....

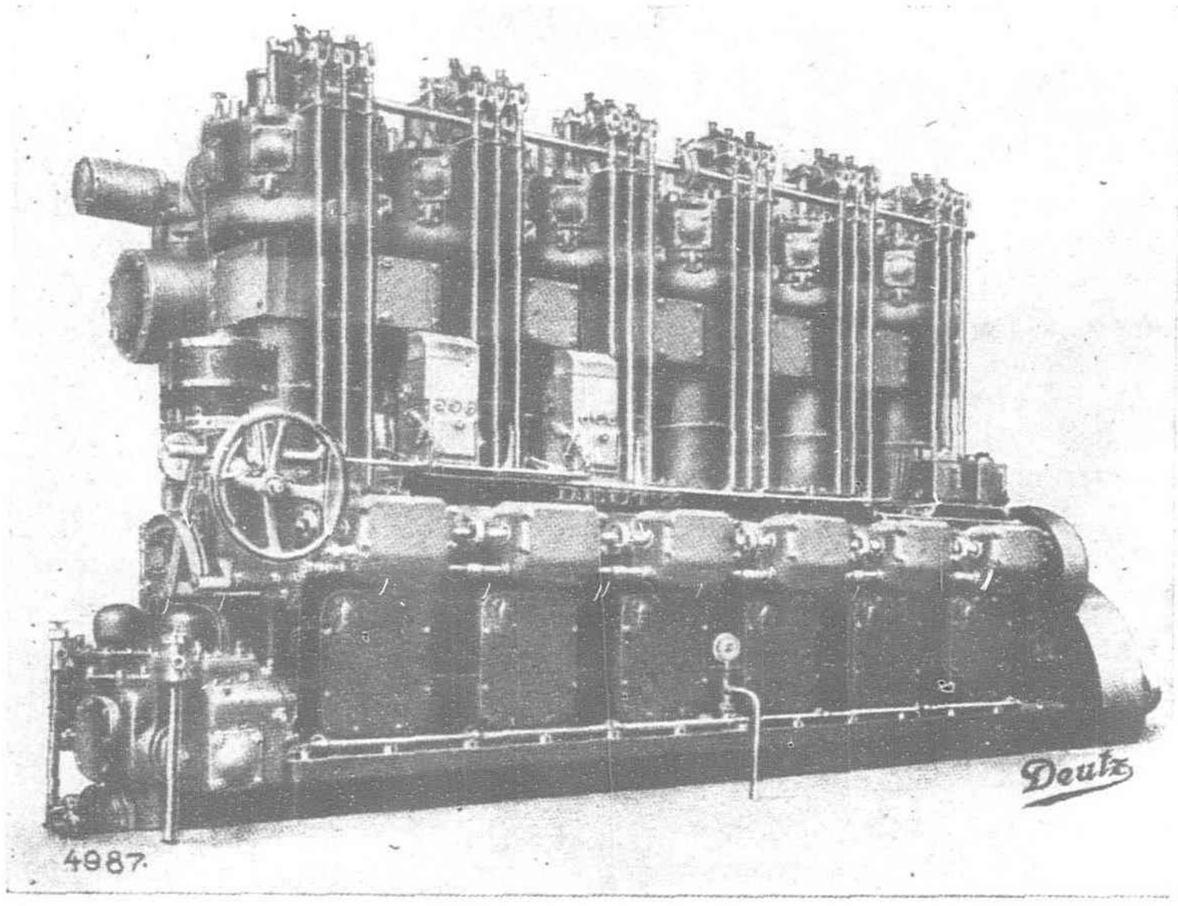
" ..... The pilot eased the ship toward the right bank and a line was thrown ashore, to the end of which was fastened a steel hawser. This cable, some four hundred feet in length, was then hauled ashore by the scores of coolies and fastened securely. The end on the ship was put 'round the steam capstan and all the slack taken up. Bear in mind that the engines all this time were straining at full speed.

" Now began the haulage. The pilot headed the ship toward mid-stream ; the inch wire hawser was as tight as a piano string. The ship's direction was then changed back toward the right bank, the steam capstan the time taking up on the slack in the wire cable. This process was repeated again and again until the ship

Loading Cargo at Chungking



M/V "I'Tu"



Six-cylinder Marine Diesel Engine, Type SVMS 158

was over the apex of the rapid. The shore end of the hawser was now cast off, the capstan returning it to the ship, and at full speed we continued up river, but only after a sampan containing representatives from the village of Yeh-tan had come alongside and collected—I am forced to add, following much talk-talk or " walla-walla " as to the amount—the silver dollars in recompense for the service that the coolies of Yeh-tan had rendered." It had been a trying strain for the ship, and so it is every time that a ship is compelled to heave. And at all times there is the great danger of a ship hitting a submerged rock and being entirely destroyed. The temperament of the Yangtze River at its upper reaches is always changing. Masters fear it, for at any moment disaster might show itself.

The *I'Tu* worked well on the Upper River and thereby proved herself satisfactory to her Captain and owners. She returned to Shanghai with a full cargo and was soon off up river again.

Before going into explanatory detail as to the new ships that the Yangtsze Rapid Steamship Company are putting into service, it would be well to summarize the present holdings of that shipping concern and its subsidiary company, the Yangtsze Mail Line. Seven river steamers fly the Yangtsze Rapid flag. The *Chi Ping*, *Chi Nan*, *Chi Ta*, *I'Ping*, and *I'Ling* are coal burners. The tug *Yeh Tan* burns oil, and the *Chi Chuen* is being changed from a coal burner to an oil burning ship. Incidently, except for the Standard Oil ships, the only merchant-ships on the Upper Yangtze under the United States flag are Yangtsze Rapid ships. Among the other flags are the British, Chinese, Italian, German, French and Japanese.

Within the past two years competition between the various shipping concerns sending their craft on the Upper River has become keen indeed. This has decidedly brought down freight rates. Some of the smaller and more obsolete steamers have been operating at a loss. The situation demands : swifter ships that are capable of making more trips per season ; ships which through better planning will have larger cargo carrying space, and will be less inviting for " pidgin-cargo ;" ships with small draft, that facilitates running even during the very low water while the steamers of greater draft are waiting for the water to rise ; ships that are cheaper to operate, through a minimum in fuel consumption ; ships of durable construction, that do not jeopardize their schedule because of tie-ups for repairs. Needless to say, the efficiency of the acting managers representing the shipping company in the various river ports is of vital importance. For to them goes the problems of keeping the ships full of cargo, obtaining the maximum amount in shipping rates, getting the ships on their way as quickly as possible, and a hundred other problems.

It is highly improbable that any ships to be constructed for cargo work on the Upper River will be powered with coal burning steam engines. A new day has firmly established itself, the day of the Diesel Engine. Its advantages are several, and in every need for improvement that I have just named, it will assist to a marked degree. I grant that its initial cost is more, but think of the saving that can be brought about through the cutting of fuel consumption. The motor-room of a diesel motored ship is much smaller than the engine and boiler-room combined of the same size steam vessel. The weight of the entire diesel power-unit is considerably less than that of a steam power-unit. That saving in space and in weight can be given over to cargo space and to net tonnage, which in itself is a very important item.

The Managing Directors of the Yangtsze Rapid Steamship Company were not slow in analyzing the shipping situation on the Upper River. Their first move was to order three new motor ships of the most modern design. The first, the *M/V I'Tu*, was to be ready in March ; the second, the *M/V I'Fung*, was to be ready in May ; the third, the *M/V I'Chang*, was to be turned over to the company in August. With these new ships in operation a schedule has been worked out whereby the eleven hundred ton capacity freight carrier *I'Fung*, as well as two motorized lighters, each being capable of transporting over four hundred tons, will make the Shanghai to Ichang run only and in so doing will supply with cargo the six steamers on the Ichang to Chungking run. The two new ships *I'Tu* and *I'Chang* will run from Shanghai to Chungking and back with through cargoes only. This will bring into existence a faster through service and also it will do away with the shifting of cargo at Ichang, in itself an important saving.

Now, let us have a closer inspection of the three new motor ships, in the order of their completion. First of all came the *M/V I'Tu*, built by the Huh Hsing Engineering and Ship Building Works, and powered by two Benz six cylinder Diesel motors, each rated at five hundred horse power. The contract speed called for was 13.6 knots and was proved in the trial runs. The motors are capable of 275 r.p.m. and all during the maiden trip to Chungking they stood up very well. One little appreciates the problems and strains that ship is put through on the Upper River until he has made the trip himself. They are *most* severe.

To continue, the *I'Tu* is 150 feet long, with a beam of 27 feet. I have previously referred to the fact that the *I'Tu* was planned along new lines. This beam, for the length of the ship, is less than the beam of the conventional Upper River merchantman, but gives her neater lines. In addition, instead of the usual rather blunt bow, the *I'Tu* tapers to a degree that cuts down the water resistance remarkably ; she slips through the water with exceeding ease. I have also made mention that her two propellers do not turn in tunnels but are exposed. This does away with the piling up of the river immediately astern, through the powerful discharge of water by the propellers from the tunnels. The blades being exposed, there is the possibility of them hitting rocks but in the long run the tunnelless system is the most practicable.

Another important feature of the new *I'Tu* is that she is as " pidgin-cargo " proof as planning could make it. The practice of the crew carrying cargo not on the ship's manifest and for which the shipping company collects narry a penny has been in existence as long as steamers have run on the River and has always been a thorn in the side of shipping concerns. The *I'Tu* is considered " pidgin-cargo " proof and has been built in the following manner. The only exits from the holds are hatches leading to the two 'tween decks. All cargo from the 'tween decks must be removed from four cargo-ports on either side of the ship. These doors are padlocked on the inside by the Compradore as soon as his ship is loaded, there being a ladder in each of the 'tween decks leading through a hole in the deck above which permits his exit. These ports are then closed and padlocked. The system should prove very satisfactory. Undoubtedly, the padlocks will be changed every so often.

The cubic foot space given over to the power-room of a steam operated ship is considerably more than the space required by a diesel propelled ship. It is evident, therefore, that the *I'Tu* has a good bit more cargo space than she would have had under steam. Her gross tonnage is listed at 671.18 and her net tonnage is 338.36, which in itself shows this significant fact. Her maximum draft is 9 feet, with a lower hold depth of 10 feet and a 'tween deck measuring in height just 7 feet. I have mentioned that the *I'Tu* has two 'tween decks. The division arises because of the motor-room, which is well astern. This of course means that the forward 'tween deck has considerable length as compared to the aft 'tween deck. It is some eighty feet long and extends unbroken by bulkhead from the motor-room to the crew's fo'castle. For an Upper River low-water vessel this 'tween deck space is unusually large and assists greatly toward a minimum of time used in loading and unloading cargo.

The deck above the 'tween deck is given over to the First Officer's, Chief Engineer's, Compradore's, and crew's quarters, as well as to the crew's galley and first class passengers' galley. The top deck is armoured with steel plates, has four double first class passenger cabins, the Captain's cabin situated just aft of the bridge, and the saloon. There is an abundance of deck space. The steering-engine is located just under the bridge and is run by steam. Chains running astern on either side of the ship operate the three rudders with which the *I'Tu* has been equipped.

The *I'Fung*, the second river-ship to be completed for the Yangtsze Rapid Steamship Company, has returned from a successful first trip to Ichang. She is the only craft of her design on the river and, except for accommodations for four, is a freight carrier. To those who have seen the cargo ships on the Great Lakes of North America, especially the great iron-ore freighters, may come a quicker picture of on what lines she has been planned and constructed.

Her dimensions give her a length of 278 feet and a beam of 40 feet. Bear in mind that the *I'Fung* is only to operate on the Lower and Middle Rivers; such dimensions would be highly impractical for low-water operation on the Upper River. She is twin screw and powered with two Deutz six cylinder Diesel Motors, with an aggregate horse power of 1,050, and a speed of 12 knots per hour. The New Engineering and Ship Building Works designed and built the *I'Fung*, turning her over for her maiden trip about the middle of May, at which time she bettered her contract speed by over half a knot. This ship is navigated by a single rudder.

The gross tonnage of the *I'Fung* is registered at 1,604.77 and the net tonnage reaches the astounding figure of 1,095.43 tons. This should be of vital interest to those interested in advancement of construction of Yangtze River freight carriers. The ratio derived from those figures is considerably above the net-gross tonnage ratio of the River merchantmen. I have mentioned the iron-ore carriers on the Great Lakes. Their design is very simple: except that the *I'Fung* is motor driven instead of steam operated, she resembles them in that her power-room is right astern as are the quarters of the engineers and "black gang;" her navigating bridge is forward as are the quarters of the captain, officers and crew; and running between, for the greater length of the ship, is nothing but cargo space. The exception being on the *I'Fung* that amidships are her fuel-oil tanks, in the hold, and also a mast to the foot of which are attached two booms which assist greatly in loading and unloading in Shanghai. These are rigged with a pair of steam winches and the movement of cargo is done through two hatches in the deck. The loading and unloading is facilitated by side ports that are locked when not being used and lead to the 'tween deck. Two hatches also penetrate this deck and are the "cargo doors" to the ship's hold. The loaded draft of the *I'Fung* is 9 feet 6 inches; the depth of the lower hold is 10 feet; the 'tween deck is 7 feet in depth. When the side-ports are closed, they are water-tight. As originally planned the *I'Fung* was to have her navigating bridge aft, just forward of the engine-room, but upon further planning it was thought more practical to shift it forward to its present position. The *I'Fung* is owned by the subsidiary company of the Yangtsze Rapid Steamship Company, the Yangtsze Mail Line.

The Upper River merchantman which is expected to be the pride of the Yangtsze Rapid Steamship Company has not as yet been completed. Her name will be the *M/V I'Chang* and should be launched sometime in August. Into the plans of the *I'Chang* have been amalgamated the most recent accessories; she is to be electrically operated throughout, from windlass to steering-gear, and from kitchens to water heaters. The builders claim that she will be the most modern and up to date ship on the Great River.

The *M/V I'Chang* will be 175 feet 6 inches long, with a beam of 29 feet. Her hull has been fashioned considerably after the hull of the *M/V I'Tu*, which should add to her speed not a little. The holds and 'tween decks of the two ships will be not dissimilar in reference to bulkheads, "pidgin-cargo" prevention, side-ports, fo'castle-head, position of motor-room, hatches from 'tween deck to holds, and so on. As planned, the draft of the *I'Chang* should be about 8 feet 6 inches, with a lower hold depth of 10 feet and a 'tween deck depth of 8 feet 6 inches. This 'tween deck is a foot and one half deeper than the 'tween deck of the *I'Tu* and of course gives the *I'Chang* that much more cargo space. Her net tonnage will be about 500 tons and her gross tonnage about 900 tons.

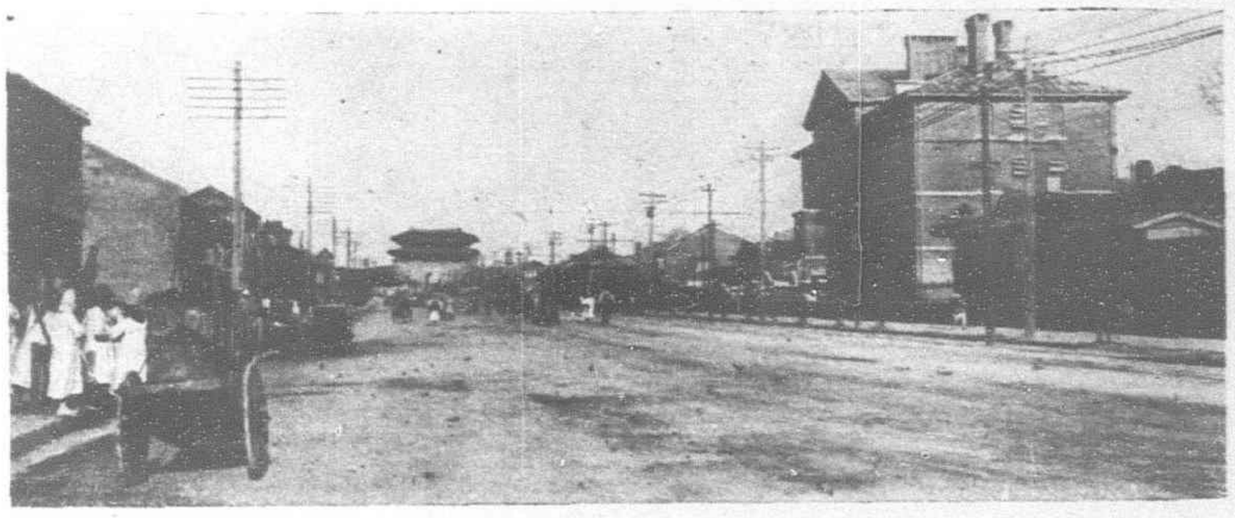
A. C. Seidel Engineering and Ship Building Company have planned and are building the *I'Chang*. That concern is the agent for the Körting Diesel Motors and is powering the new *I'Chang* with two six cylinder Körting Diesels, each of which is listed at 600 horse power, or a total of 1,200 horse power for the pair. The ship's speed will be approximately 14 knots which should make her the fastest Upper River low-water merchantman on the Yangtze and also should make heaving rapids at even the worst seasons something not to be countenanced. She is to be equipped with three rudders worked, as I have mentioned, by electric steering-gear. The windlass and capstan are to be electrically operated as are the ship's whistle and siren. There are to be accommodations for fourteen first class passengers, four of the cabins being double and of the de luxe type. All the cabins are to be electrically heated. The Foreign galley will have electric stoves as will the Chinese galleys. All water on the ship will be electrically heated. In other words, as I have already insinuated, the *M/V I'Chang* will be electrically operated throughout and in that feature will be individual in so far as Yangtze River Merchantmen are concerned.

The conversion of two lighters, which for the past several months have been towed between Shanghai and Ichang by the tug-boat *Yeh Tan*, will be commenced shortly. These will be extensively gone over, motorized with six cylinder Benz Diesel Motors rated at 270 horse power, given 'tween decks, crew's quarters, and a navigating bridge. The salient features of the two motorized Yangtsze Rapid lighters, No. I and No. II, will be:

Length ...	148 feet 6 inches	Engines ...	single six cylinder Benz Diesels
Width ...	26 ,,		
Depth lower hold ...	8 ,, 6 ,,	Power ...	270 h. p.
		Speed ...	about 8 knots
Depth 'tween deck.	7 ,,	Gross tonnage	about 750 tons
		Net tonnage	about 420 tons
Draft ...	6 ,, 6 ,,		

Roads in Korea

IN old Korea with all its own civilization good roads were entirely lacking, and what roads it did possess were usually left in a state of utter disrepair. Even the ancient "grand highway" from Keijo to the Chinese border was barely grand enough to admit of a cart being driven along it, so what the rest were like can easily be imagined. It is true the Korean Government used to allot certain sums of money to the various districts for purposes of road repair, but much of this, it is said, went into the pockets of the local magistrates, and practically nothing was done to the roads. On the country being brought under Japanese management, great efforts were consequently put forth to improve this backward condition, and it was planned to construct a regular network of roads of three classes, of which the first and second classes were to be looked after by the Government itself, and the third by the provinces, while in urban districts all classes were to be under municipal control.



Street Scene in Keijo

When repairs were undertaken in former times, corvée or compulsory service was always called into play, and this usage was continued even into the new régime by conscripting those persons unable to pay their assessment. In addition, the landed gentry were often induced to surrender land for roads free of cost. But this is now changed, for in 1919 it was prescribed that in the making of roads at national expense corvée should be dispensed with, and the land needed purchased at a fair price, though in the case of roads at provincial cost the old practice was still retained in force in consideration of its special connection with local interests.

Brown Boveri Locomotives on the Japanese Government Railways

B_o—B_o Goods Locomotives

THE Yamate Lines, on which these machines ran at first, were still supplied with 600-V direct current when the locomotives were ordered. They were later changed over to the same contact-line pressure as that on the Tokyo-Yokohama-Sakuragicho Line, namely 1200 V. As both lines will some day be converted to operate on a pressure of 1500 V, which is to be adopted as the standard pressure on the J.G.R., the B_o—B_o locomotives had to be equipped for running on all three pressures. With a 10 per cent. voltage drop these pressures have mean values of 540, 1080 and 1350 V.

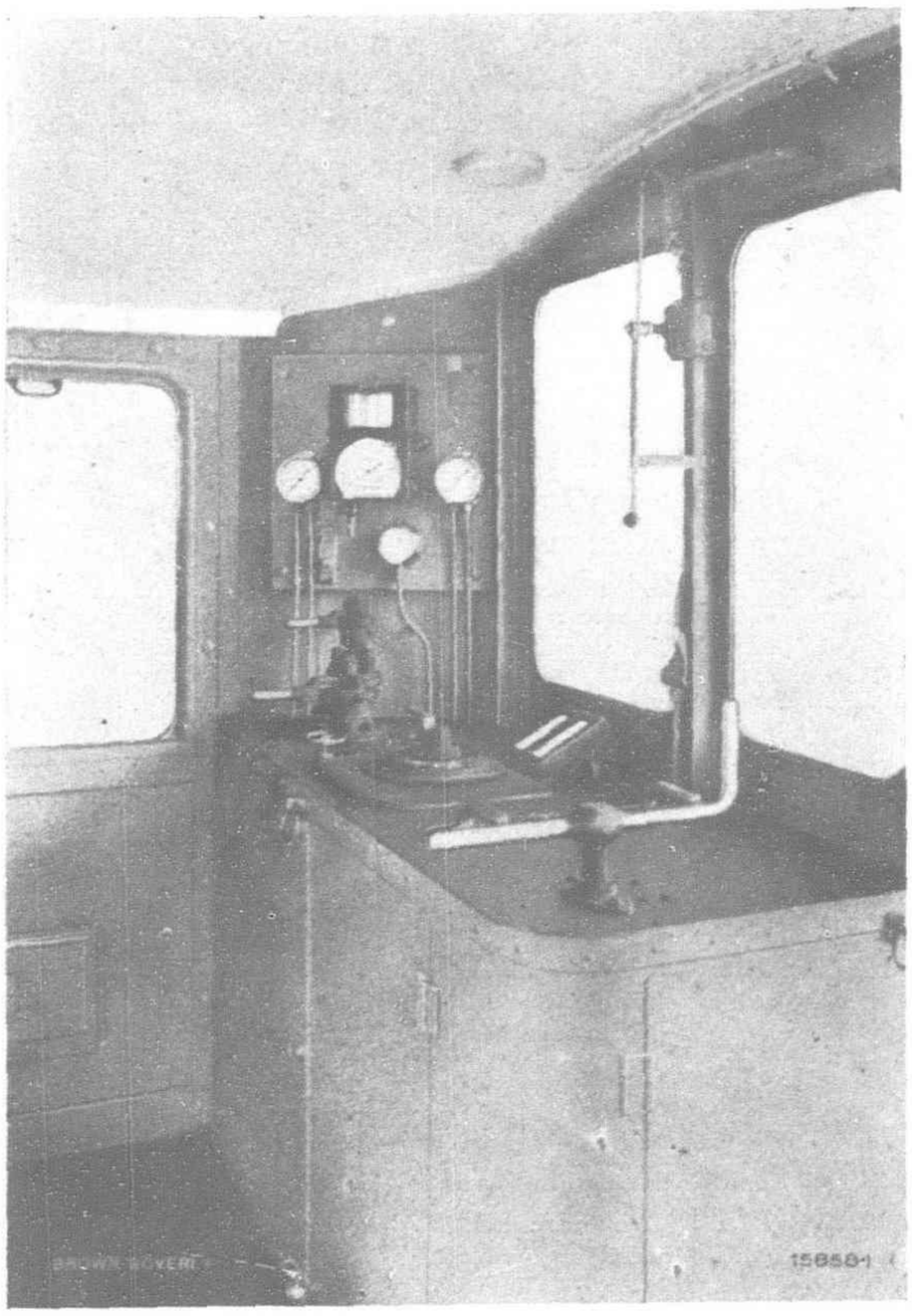
It must be possible to change over from 540 to 1080 V at any time, as the locomotives run directly from the Yamate Lines on to the Tokyo-Yokohama section. For service with a contact-line pressure of 1350—1500 V, the connections will be changed over once and for all. When running on the lowest pressure of 540 to 600 V, all the four traction motors are connected in parallel. At 1080 to 1200 V, two groups of two motors connected in series are connected in parallel. The connections for 1350 to 1500 V are the same, and the motors develop the same torque, but, corresponding to the higher pressure, run at a greater speed and develop more power. All the motors have a field tap for giving a speed increase of approximately 15 per cent. on the last notch, in case this should be necessary due to a drop in the contact-line pressure.

The starting resistances (cast-iron elements) are connected up in four groups in series and parallel for the lowest pressure. For the 1080—1200-V pressure, two of the groups are connected in series-parallel. The connections are the same at 1350—1500 V but the total value of the resistance is increased by removing the short-circuiting bridges.

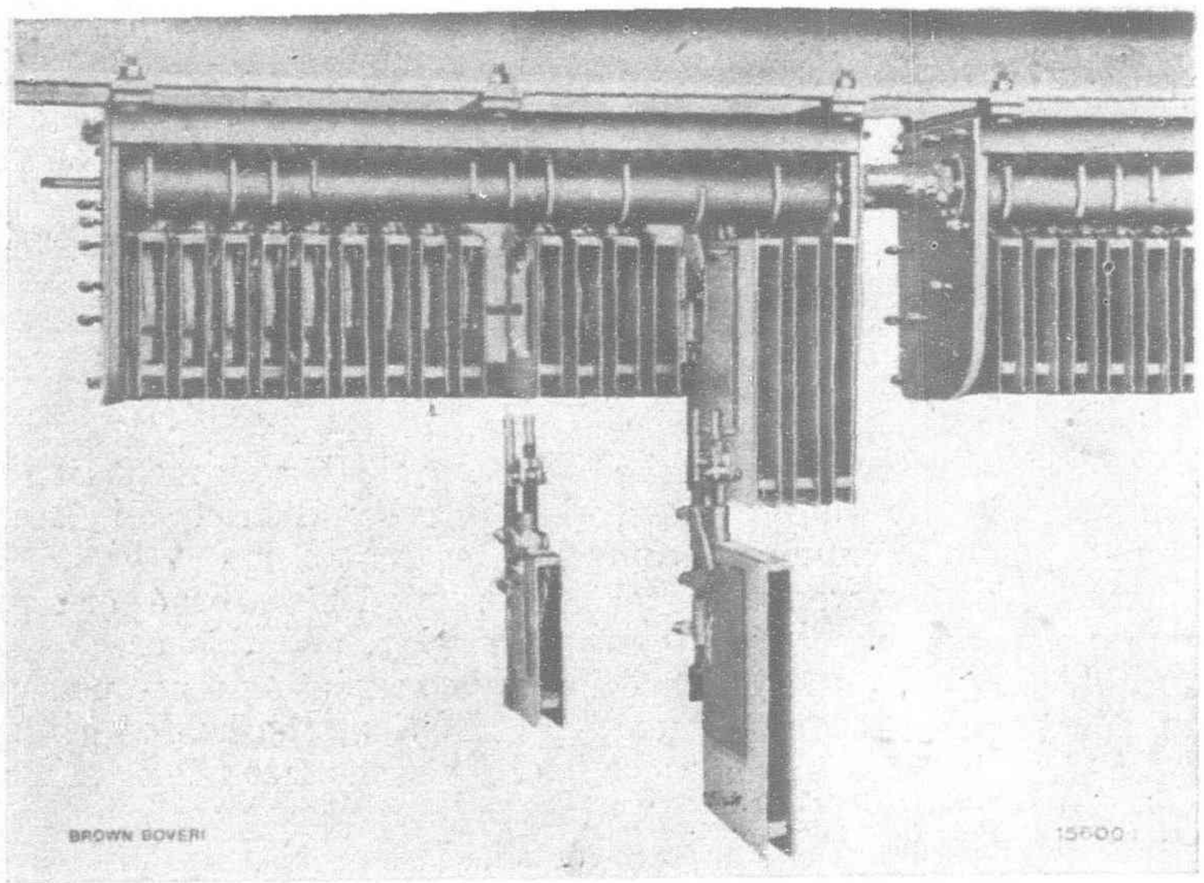
Series-parallel connections are again used when adapting the motor-compressor sets to the various pressures. The compressor sets are coupled together mechanically, and at the two lower pressures the motors run with field weakening, but at the highest pressure with full field. The change-over from series to parallel connections is made by means of an automatic switch, but the change-over from the field-weakening position to full field when going on to 1500 V must be made by hand on the motors themselves.

Finally, the converter set was provided with an auxiliary exciter which keeps the speed and therefore the secondary pressure constant to within ± 10 per cent. at all loads and with contact-line pressures from 540—1200 V and 1080—1500 V. Resistances of 3.3 Ohms for damping current rushes on switching in are connected in series with the motors of these sets. When running on 1500-V contact-line pressure these resistances must be increased to 7 Ohms each by removing a short-circuiting bridge on the resistance.

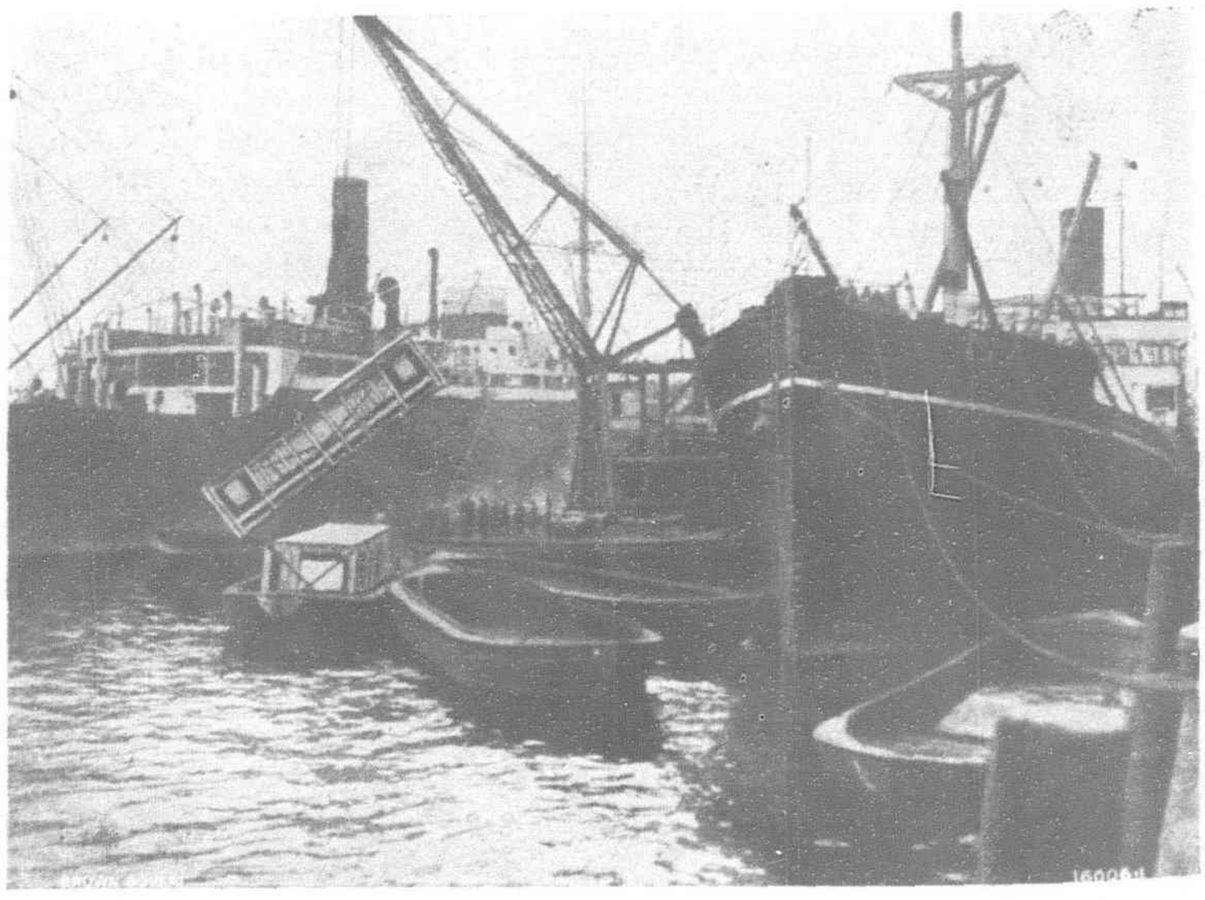
(1) *Mechanical part.* There are no innovations of particular note in the mechanical parts of these machines. The locomotive is a standard bogie type but with the two bogies coupled together so that all drawbar pulls or thrusts are transmitted directly from the one to the other and not through the locomotive frame. For this reason one of the bogie pivots has been given a certain amount of play in the direction of the longitudinal axis of the locomotive. The layout of the body is characterized by a central gangway connecting the two driver's cabs. The electrical equipment, resistances and auxiliary motors are arranged to the left and right of this where they are readily accessible and can be easily supervised.



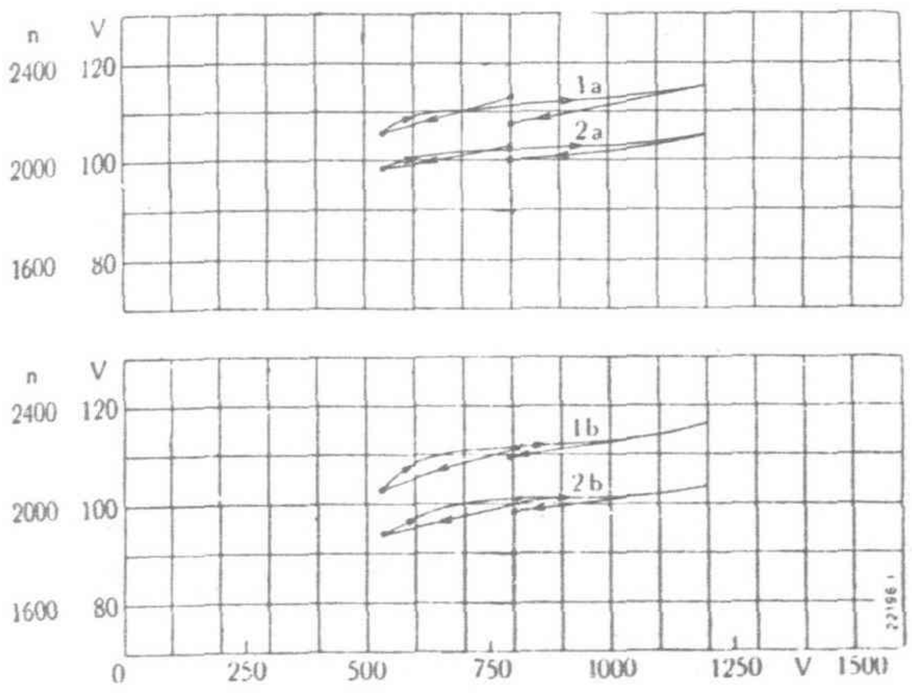
Driver's cab in the B_o—B_o Locomotive No. 1020 of the Japanese Government Railways



Controller for the B_o—B_o Locomotive No. 1020 of the Japanese Government Railways



Trans-shipping the bodies of the B_o—B_o Locomotives, Series 1020, for the Japanese Government Railways from Lighters into the Steamer "Lima Maru" at Hamburg



Japanese Government Railways. B—B Goods Locomotive No. 1020. Pressure Converter. Variation of the Speed and Generator Pressure with the Contact-line Pressure

The locomotive has been equipped with Westinghouse Type EL 14 compressed-air brakes operating on 16 blocks combined with hand brakes.

(2) *Electrical equipment.*—In this locomotive the main switch is a Brown Boveri switch with horn break and resistance, pneumatic control, electrically operated and with two over-current relays but without a no-volt release. The switch can, however, be tripped by hand from each cab. When being tested, the switch tripped currents of 10,000 A at 1600 V perfectly.

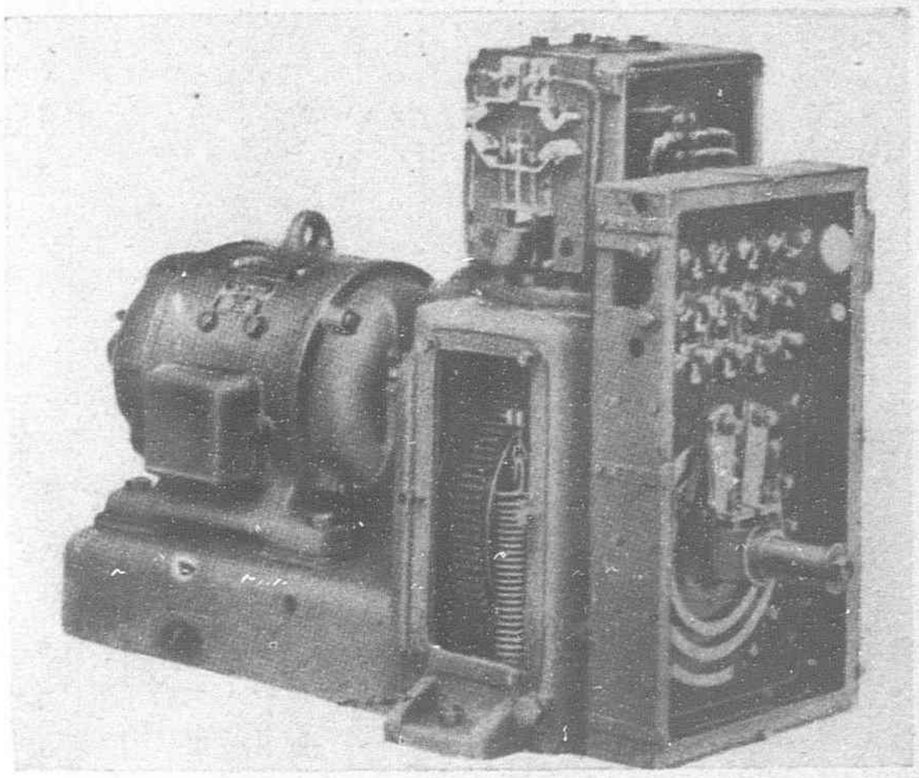
The locomotive was equipped with four 6-pole tram-type series motors type GDTM 75/-6,22 ; the particulars of each are as follows : one-hour rating 250 H.P. at 350 r.p.m., 1080/2 V, and a one-hour rating of 345 H.P. at 530 r.p.m., 1500/2 V ; diameter of wheels 1400 mm ; reduction gear drive at each end of the motor with teeth cut in opposite directions ; reduction ratio 3.9 : 1 ; forced ventilation by means of a separate blower delivering 2.8 m^3 of air per sec. at about 70 mm of water with converter set direct coupled to blower.

The motors are regulated by a controller driven by an auxiliary motor. The controller has eight series, four parallel and one field-weakening position, and is built up of two parts coupled together, each part having 18 cam-operated contactors, four large and fourteen small, provided with individual magnetic blow-out.

The cast-iron starting resistances have natural cooling obtained by means of an air conduit brought in through the roof. An electrical brake was not stipulated.

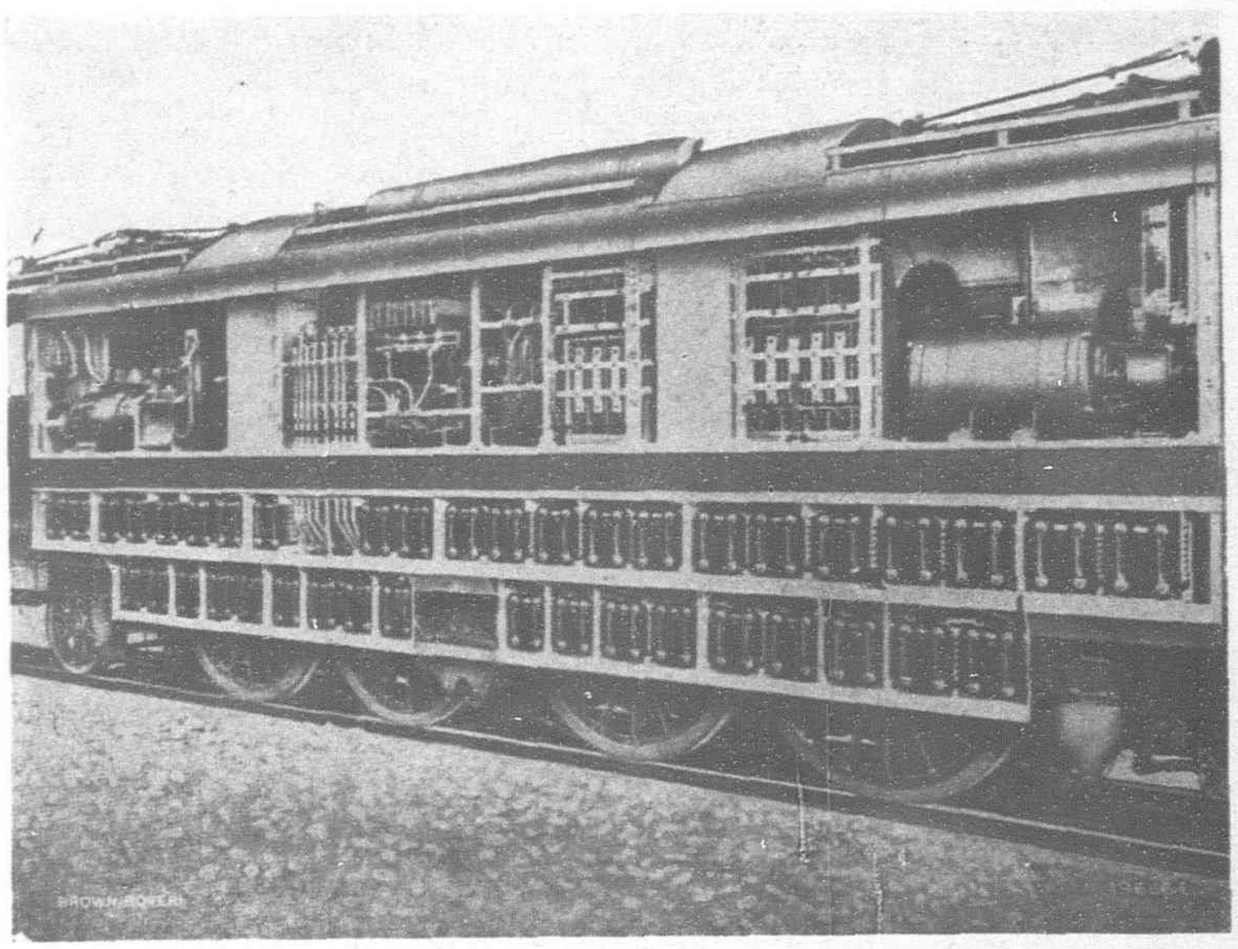
An electro-pneumatically operated switch, mechanically interlocked with the controller, is used for changing over from 600 to 1200 V. It has three positions for 1200 V and three for 600 V, enabling either four motors to be in circuit or one or the other pair to be cut out in the event of a motor becoming damaged. If a motor group is cut out, the controller drum, which is on the 1200-V position, can only be moved through the series positions.

A change-over switch is also provided for each motor group. These switches are electro-pneumatically operated and can also be employed for cutting out a defective motor group.



Driving Apparatus with Servo-motor for the Controller

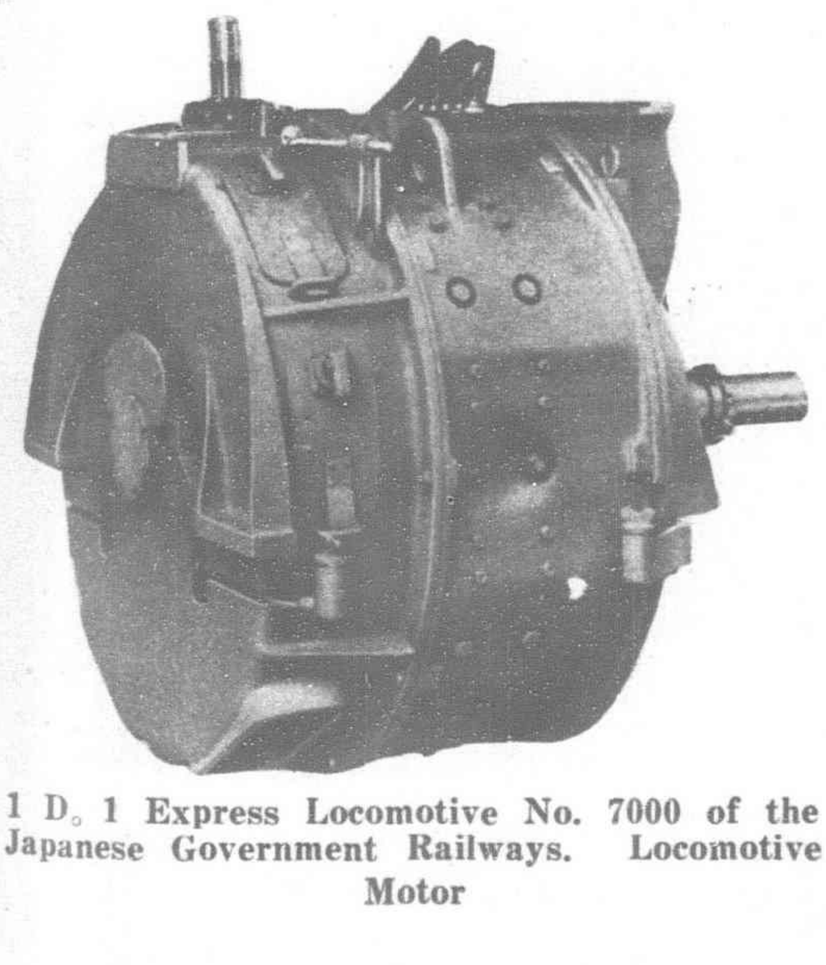
The master controller in each driver's cab has main and auxiliary drums. The main drum controls the main switch and main controller and the auxiliary drum the voltage change-over switch and the two reversing switches. The apparatus is arranged so that multiple-unit control can be used for the locomotive. The low-tension auxiliary apparatus is supplied at 110 V from the generator already described. An accumulator battery is not provided. The motor of the converter set is connected up before the main switch of the locomotive so that, as soon as the current collector has been raised, the converter can start up without it being necessary to close the main switch ; current for working the control apparatus is thus immediately available.



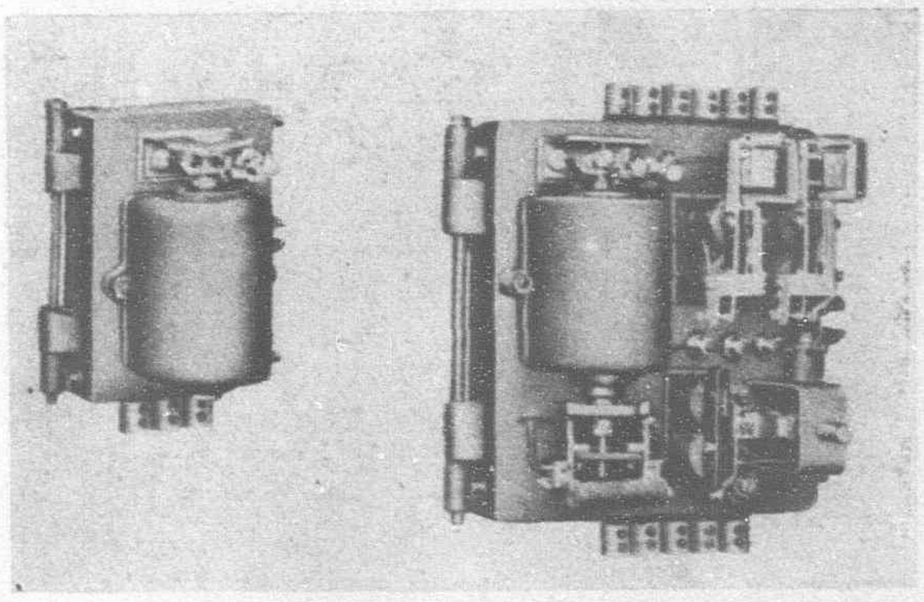
1 D_5 1 Express Locomotive No. 7000. View of the non-driving Side

1 D_0 1 Express Locomotive

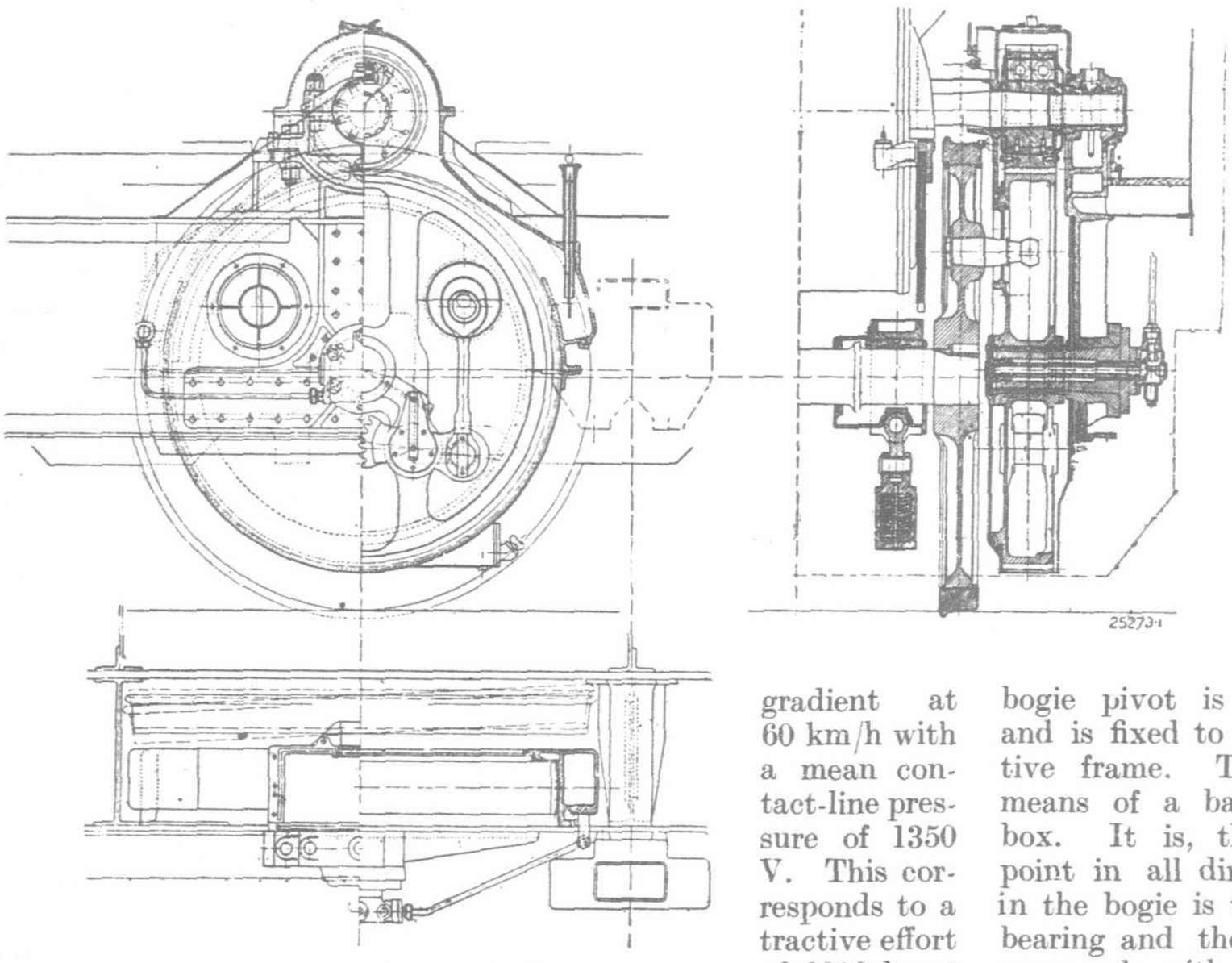
The fastest through-train in Japan is the Limited Express which runs on the Tokaido-Sanyo Line between Tokyo and Shimonoseki, covering the distance of 1140 km. in almost exactly 24 hours. The average speed is thus 47.5 km/h, and the maximum speed developed 85—90 km/h. This train is run once daily in each direction. It runs very punctually and is the pride of the J.G.R. The specifications for the express locomotives to be built by Brown, Boveri and Co. were drawn up with the conditions required for maintaining this service of trains as a basis. The trailing load was put at 470 tons and the total train weight, including locomotive, at 550 tons, to be hauled up a 1 per cent.



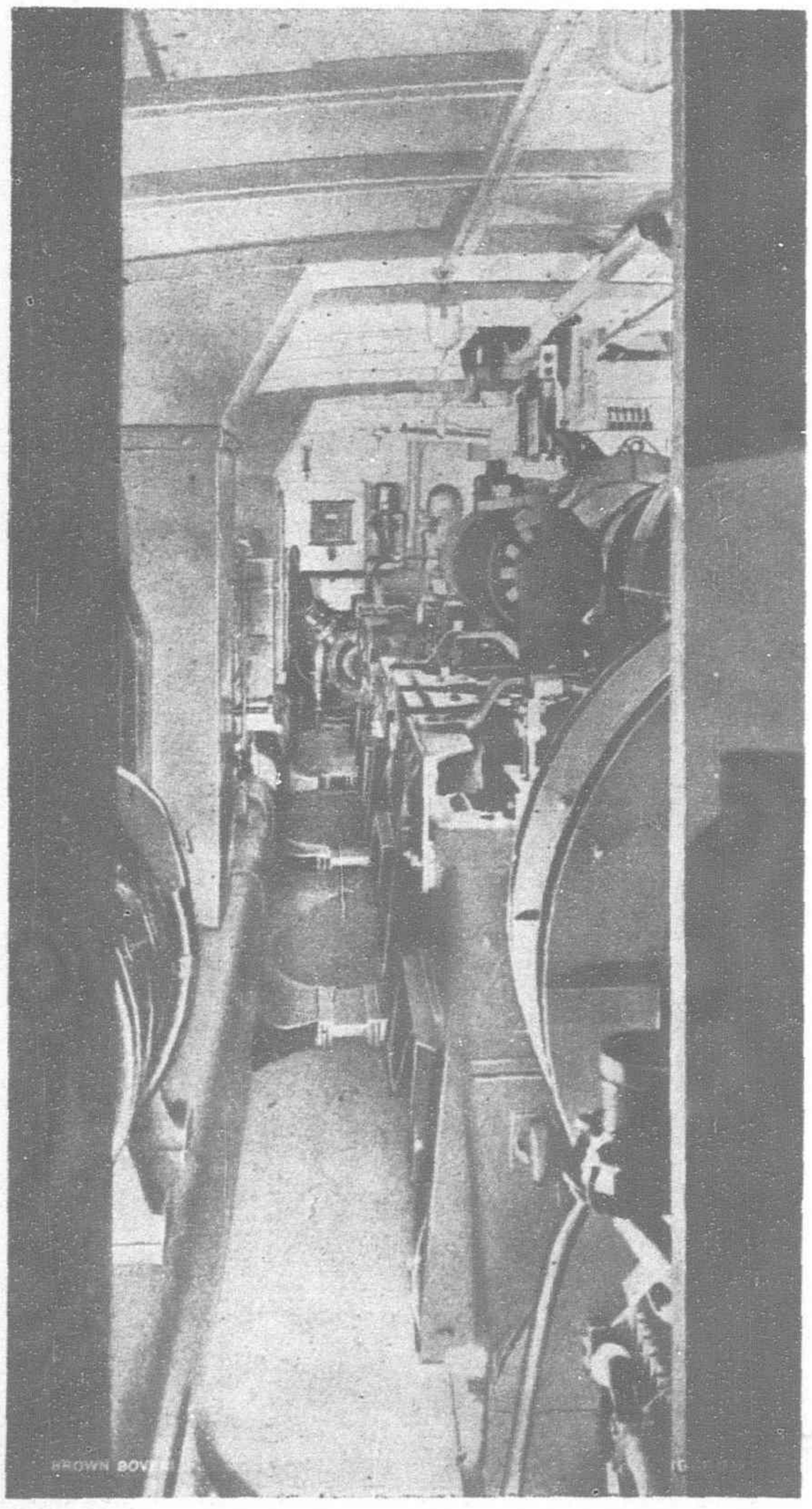
1 D_0 1 Express Locomotive No. 7000 of the Japanese Government Railways. Locomotive Motor



1 D_0 1 Express Locomotive No. 7000 of the Japanese Government Railways. Battery Charging Apparatus with Auxiliary Apparatus type K



Individual axle drive of the 1 D$_o$ 1 Express Locomotive No. 7000 of the Japanese Government Railways



1 D$_o$ 1 Express Locomotive No. 7000 of the Japanese Government Railways. View of the High-tension Compartment Showing Operating Gangway

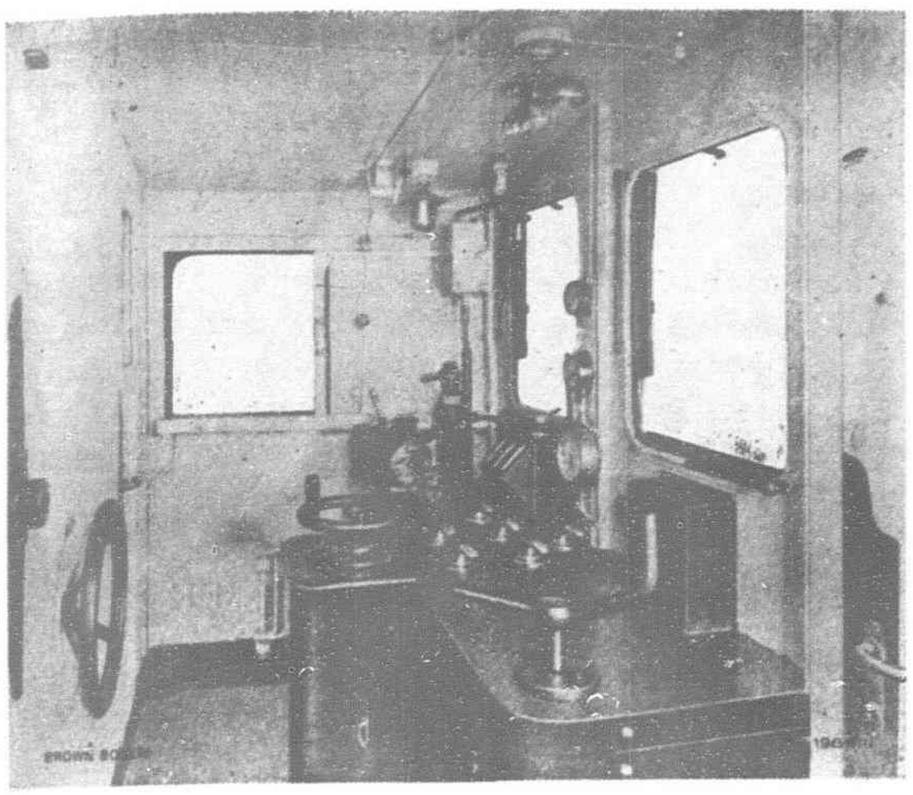
gradient at 60 km/h with a mean contact-line pressure of 1350 V. This corresponds to a tractive effort of 9000 kg at the tread of the wheels and must be regarded as a one-hour rating. The maximum service speed stipulated was 100 km/h. On the Gotemba section, with a maximum gradient of 2.5 per cent. two locomotives are used on each train. The locomotives have therefore been equipped for multiple unit control. The two machines designed by Brown, Boveri and Co. are of the 1 D$_o$ 1 type with Brown Boveri individual axle drive and four driving motors.

Mechanically these locomotives are worthy of note chiefly on account of the arrangement of their running gear. Of the four sets of 1600-mm diameter driving wheels, the two middle ones are rigidly mounted in the frame, *i.e.*, they have vertical movement only. The two outermost sets of driving wheels are combined with the two sets of pony wheels (939 mm diameter) into bogies. The excellent running of these machines is due, essentially, to the design and arrangement of these bogies in combination with the Brown Boveri individual axle drive. A fuller description will therefore be given of the bogies. (German Patent No. 390341).

Each end driving axle runs in a double axle box of cast steel. The pony axle has only single bearings which are situated in front of a cast-steel guide member and are supported by leaf springs mounted above the bearings. The doubt axle box of the driving axle is connected with the guide member of the free axle through the frames of the bogie. The bogie pivot is located immediately behind the driving axle and is fixed to a strong cast-steel cross-member of the locomotive frame. The bogie is attached to the bogie pivot by means of a ball and socket bearing fixed to the double axle box. It is, therefore, free to move as a whole about this point in all directions. The driving force of the driving wheel in the bogie is transmitted to the locomotive frame through this bearing and the bogie pivot. The maximum movement of the pony axle with regard to the longitudinal axis of the locomotive is 2 × 85 mm, the movement being limited by stops. Both the pony axles and driving axles set themselves radially to the bogie pivot. This is rendered immediately possible with the Brown Boveri individual axle drive by fitting the coupled rods with special ball-type bearings. Two leaf springs fixed centrally above the axle are used for centring. The initial load on the springs is 1400 kg and a returning force of 2900 kg is exerted when the bogies are displaced by the maximum amount.

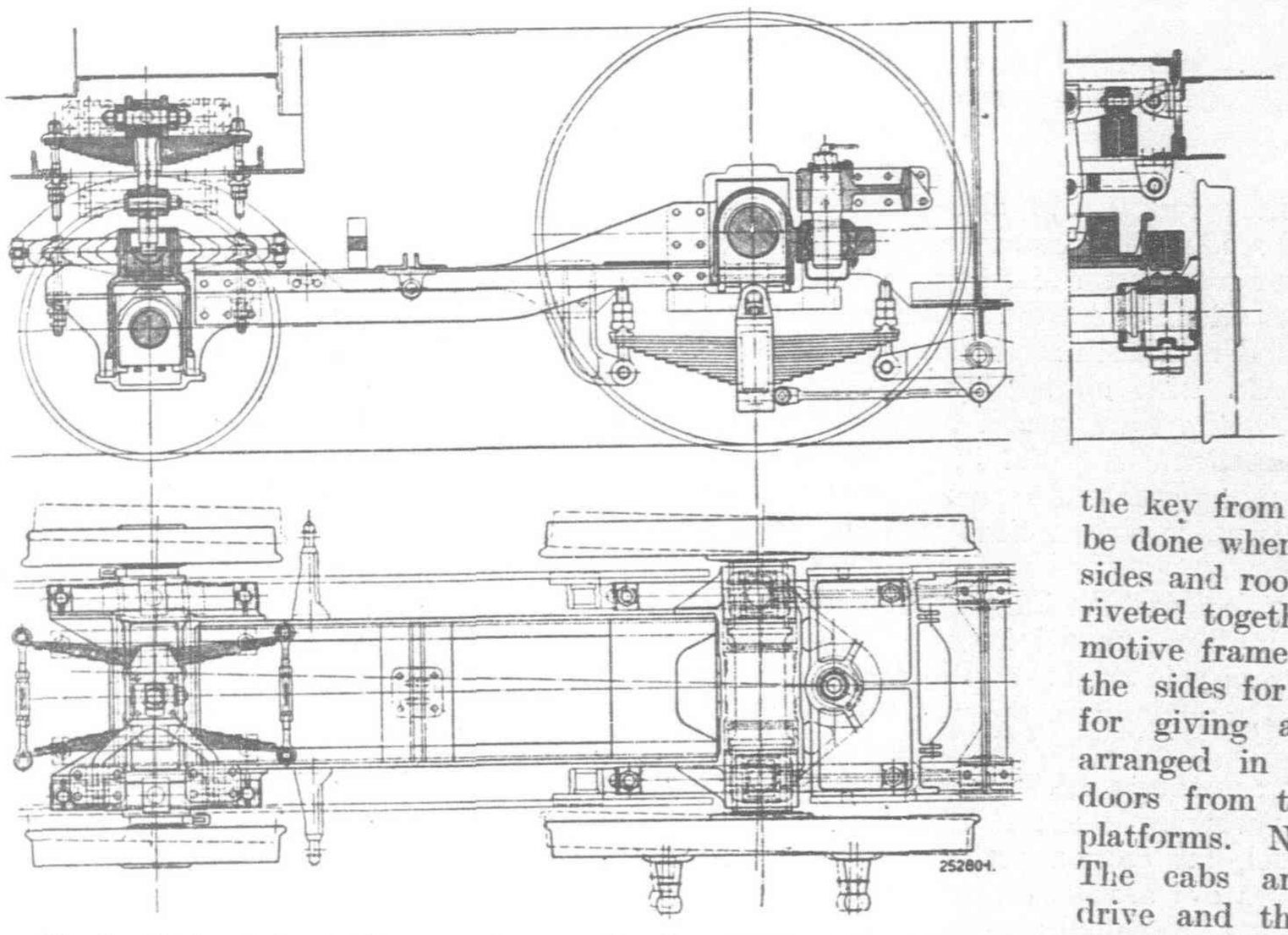
The underframe of the locomotive rests on each bogie at three points *viz.*, by means of a vertical support with spherical foot-bearing on a plate above the pony axle. and by means of two leaf springs secured to the double axle box of the

1 D$_o$ 1 Express Locomotive No. 7000 of the Japanese Government Railways. Gangway



1 D$_o$ 1 Express Locomotive No. 7000 Diver's Cab

driving axle. The spherical center pin socket of the first-mentioned support enables the guiding member to move laterally with entire freedom. The support is connected to an equalizer lying above it and this again is secured to the two upper bogie springs which support the end of the underframe. Two links fitted to the frame guide the support in a vertical direction and transmit the centring force to the underframe. The spring bands below the driving axle form the second and third points of support. Slings are suspended from the double axle box and these carry the springs on spherical seatings. The springs themselves are always kept parallel to the underframe by guide pieces fixed to the frame. The springs of all four driving axles are connected together by equalizers on each side of the locomotive in order to ensure equal pressure on all the driving axles. This is an important point where individual axle drive is employed.

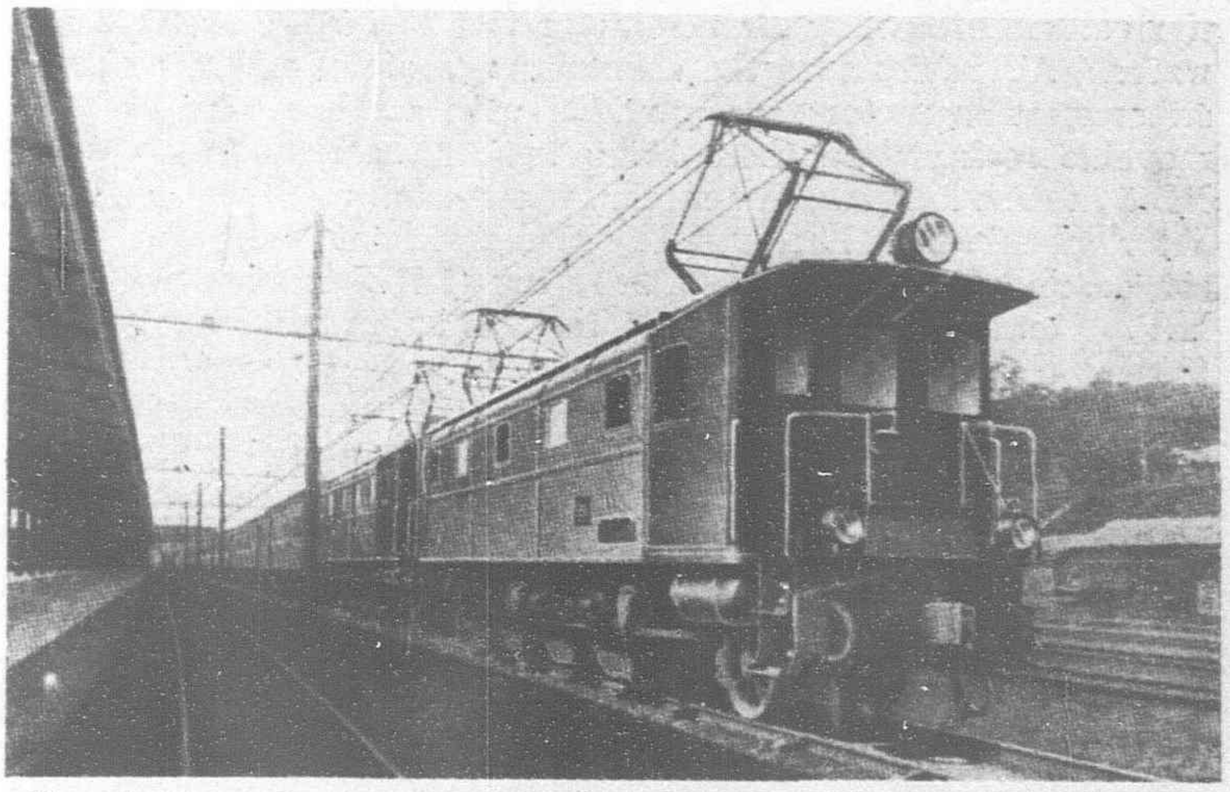


Bogie of the 1 D$_o$ 1 Express Locomotive No. 7000 of the Japanese Government Railways

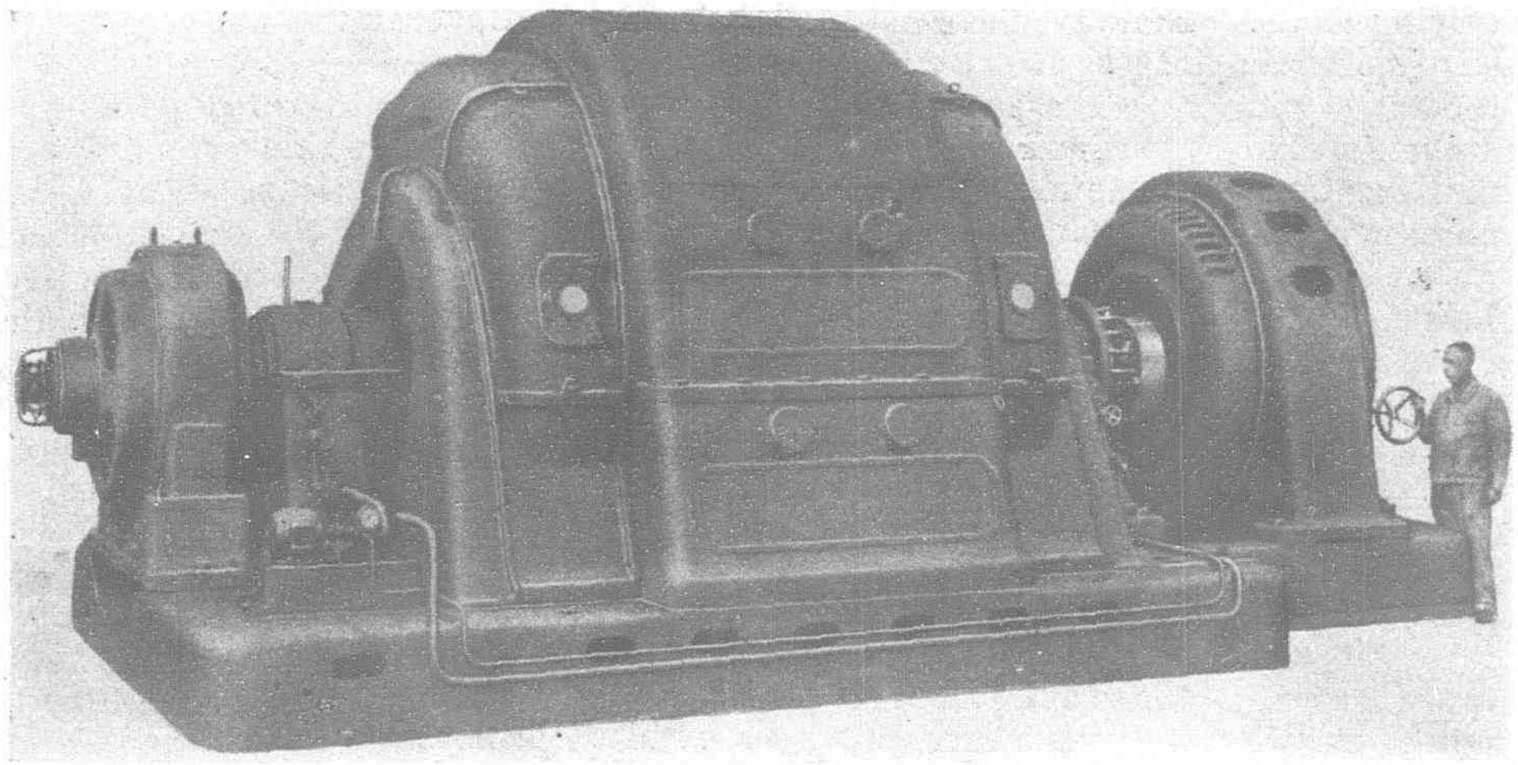
By using double series springing for the pony axle it can carry its load very gently. Since the driving axle also moves radially about the bogie pivot, a small striking angle on curves is obtained with a corresponding reduction in the wear on the tyres.

The driving axles are driven by the well-known Brown Boveri individual axle drive with single-reduction gear and flexible connection between the driving wheel and the large gear wheel. This form of coupling is of simple design and comprises two small connecting rods and two toothed segments per wheel. The coupling is built into the large gear wheel. All the drives are arranged on one side of the locomotive. The bearing pins for the large gear wheels are fixed in an auxiliary frame parallel to the main locomotive frame and not, as in the 2 C$_o$ 1 locomotives of the Swiss Federal Railways, on individual cast-steel blocks attached to the main frame. The spaces between the spokes of the driving wheels on the driving side of the locomotive are webbed in with cast iron. This prevents dust and dirt entering the casing enclosing the gears where it is cut away for the coupling pin between the gear wheel and driver. The tooth rim of the pinion is connected with the boss by four double springs; the rim is seated on the boss cylindrically, not spherically. The reduction ratio is 3.34:1. The tooth rim of the pinion is made of forged steel and the large gear wheel of special cast steel. Both metals have different hardness numbers and different tensile strengths. The wheels are neither hardened nor ground. The experience which the Swiss Federal Railways have had with naturally hard, accurately cut gear wheels has been extremely satisfactory.

The locomotive body is divided up into three parts—the machine room and the two driver's cabs. The side walls and roof of the machine room are all made of three sections, any of which can be removed separately without disturbing the others. Since all the axle drives are mounted at the one side of the locomotive, as much of the electrical apparatus as possible, together with the resistances, batteries, and auxiliary motors, were assembled at the other side in order to obtain equal wheel pressures on both sides of the locomotive. The main motors, apparatus and auxiliary motors are installed in the machine room, while the resistances, batteries and vacuum reservoir are fitted to the locomotive body. The two compressed-air reservoirs, each with a capacity of 330 litres, are mounted on the middle portion of the roof. The adjacent, detachable roof sections are provided with openings through which the cooling air from the box containing the resistances is led away by means of two conduits. The openings for the cooling air for the motors in the machine room are also in the same sections of the roof. In addition to these, other openings with protection against rain are provided in the side walls of the machine room. A gangway along the right-hand side of the locomotive connects the driver's cabs. It is also extended sideways to the compressors, vacuum pump and the control set, but is completely isolated from all apparatus under high tension. This part forms the high-tension room. It is reached by a gangway parallel to the first one after opening an interlocked door at the rear of the driver's cab, which can, however, only be done when the current collectors have been lowered. It is then unlocked by a key which is normally kept inserted in a threeway cock in the control circuit for lowering the collector. When the door of the high-tension compartment has been opened by means of this key, it is impossible to remove the key from the lock. This can only be done when the door is closed. The sides and roofs of the driver's cabs are riveted together and bolted to the locomotive frame. Platforms with steps at the sides for mounting and at the end for giving access to the train are arranged in front of the cabs. The doors from the cabs open on to these platforms. No side doors are provided. The cabs are arranged for left-hand drive and the controls so that they can be operated by the driver when seated.



Two 1 D$_o$ 1 Locomotives, Series 7000, for Multiple-unit Control Coupled to an Express Train in the Shinagawa Station, Near Tokyo



Showa Denryoku K. K., Nagoya (Japan)
Three-phase Synchronous Condenser, 30,000 KVA, 11,000 V. 60 Cycles, 600 r.p.m., with Induction Motor for Starting

The following mechanical brakes have been fitted on the locomotive :—

(1) A combined automatic compressed-air and vacuum brake operating on all the driving and pony wheels.

(2) A hand brake which works on the two driving axles nearest the cab from which it is operated, and on one pony axle.

The braking force is equivalent to 80 per cent. of the adhesion weight and 30 per cent. of the weight on the pony axles with an air pressure of 3.5 kg/cm_2. The vacuum is maintained by a rotary vacuum pump type VL 20 (made by the Swiss Locomotive and Machine Works, Winterthur) coupled to a high-tension motor for speeds of 725 and 1450 r.p.m. The compressed air is supplied by two Brown Boveri motor compressor sets type GC 3, also comprising high-tension motors direct-coupled to the compressors.

Each locomotive is fitted with both recording and non-recording Teloc speedometers, and with electrically-operated sanding gear which supplies sand to the leading and third driving axles when running in either direction. A pedal in each driver's cab is used for operating the sanding gear. The change over according to the direction of travel is made automatically by the reversing switch.

With regard to the *electrical part* the following more important points should be mentioned. The four driving motors are divided into two groups, the two motors in each group being permanently connected together in series, and the two groups in series-parallel for starting and running. A third economical running speed is obtained by using a field-weakening position when the two motor groups are connected in parallel. When starting and changing over from series to parallel, bridge connections are used. The field windings of the motors are always connected on the high-tension side, and the armatures are earthed.

The series-wound motors have six main poles and six interpoles ; mica insulation is used in the rotor and mica asbestos insulation in the stator. The motors are artificially ventilated ; the volume of cooling air per motor is 1.25 m^3/sec at 75 mm of water. Air passes over the armature and stator in parallel axial streams. The motors are provided with six brush holders on a movable rocker arm, there being two soft carbon brushes type BB 5 in each holder. The motors were tested while warm at 4500 V for one minute. Each weighs 4300 kg without pinion and blower set, or, reckoned on its one-hour rating at 1500/2 V, only 7.3 kg/-H.P. Commutation right up to the maximum speed is excellent. (90 km/h corresponds to 1000 r.p.m.)

The blower set for each group of two motors was built directly on to the motors. It comprises a high-tension series motor, continuous rating 12 kw., speed 2400 r.p.m., and two direct-coupled blower wheels. The reversing switch for each motor group is built in below the blower motor. It can also be used for cutting out by hand either of the groups should it become damaged. If this is done, the reversing switch automatically interlocks the controller and prevents it from being moved past the last series notch. Since the complete motor group is in the high-tension room, the reversing switch can be operated by hand only when the current collectors are lowered. Both blower sets are automatically started up when the main controller is moved past notch 5. They are not put in circuit while the first four notches are being used in order that there may be no noise from the blowers while shunting, which would make it difficult to hear acoustic signals. In case one of the blower sets should fail in the second unattended locomotive when double traction is being used, *e.g.*, due to the fuses blowing, a small switch operated by a vane has been provided in the air conduit on the delivery side of each blower. When the blower ceases to work, *i.e.*, when no cooling air is being delivered, the switch sets an alarm bell in the driver's cab in operation, thus notifying the driver. The circuit of the alarm bell is broken by the main controller when running on notches 0 to 5. The blower sets can be started up and the alarm device put in circuit independently of the position of the controller by means of a switch in each driver's cab. This enables the driving motors to be cooled when the locomotive is not running.

The controller contains 13 small and four large switch elements, all provided with individual electric blow out and all operated by a common camshaft. The camshaft is actuated by a small 0.2-kw., 100-V series motor through reduction gear, friction clutch and ratchet wheel. Control is effected by the master and auxiliary controllers according to standard Brown Boveri practice. There are altoget her 18 notches : 11 series, six parallel and one field weakening.

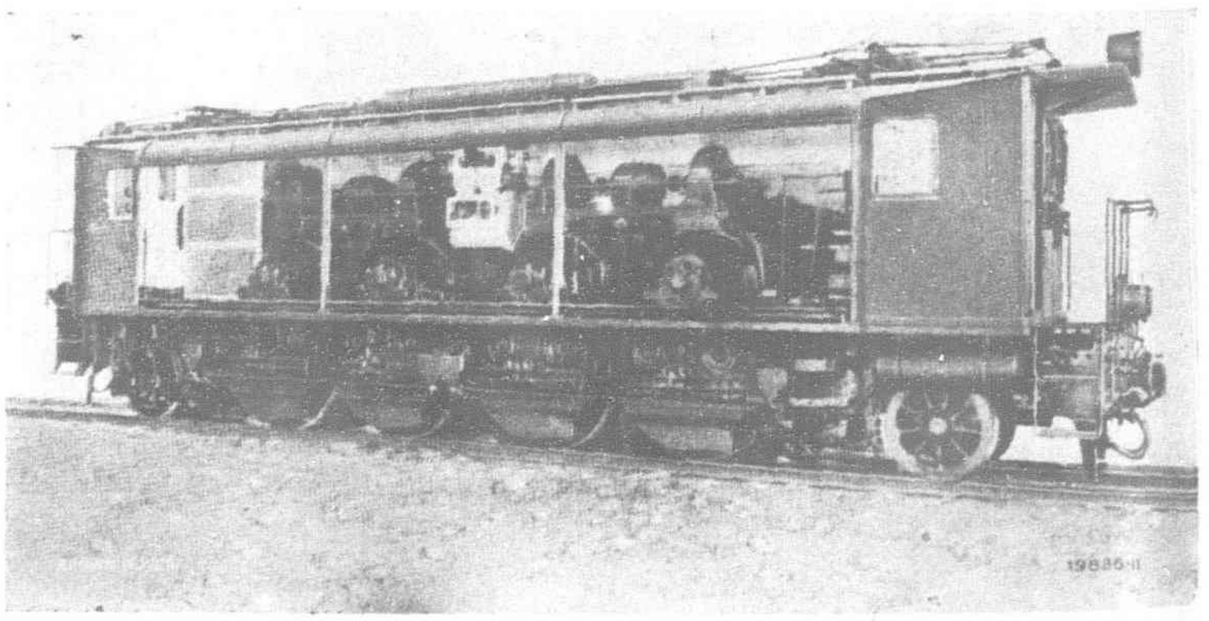
The field is weakened only when using parallel connections. It is accomplished by means of a separate field-weakening switch comprising four cam-operated switch elements similar to the small elements in the controller. The field-weakening switch is operated directly from the master controller. There is an interlocking contact on notch 17 of the main controller so that the last parallel position must be reached with full field before changing over to the field weakening position.

Although not used for continuous braking, the starting resistances are made as capacity resistances and built up of cast-iron elements with natural ventilation.

The main switch, reversing switch and field-weakening switch are all electro-pneumatically operated. The contactors for the vacuum, compressor, blower and converter sets, as well as the valves for the current collectors and sanders, are all electro-magnetically operated. Current at a pressure of 100 V is used for the control circuits.

This auxiliary current is produced by a converter set (motor generator) provided with an auxiliary exciter to keep the speed constant at any contact-line pressure, which varies from 900—1500 V. The secondary output of the converter is 5.8 kw. at 113—137 V. The generator of the converter set is used for charging a lead accumulator battery, with which it also works in parallel. The battery consists of 51 cells with plates of large surface area. The capacity is 100 Ah when discharged within ten hours ; the normal charging current is 25 A. Both in this locomotive and those of the Usui-Toge Line the various switching operations are carried out by a switching apparatus type K of new design, the principle on which it works being as follows :—

After the converter set has been connected up on the high-tension side, the generator and battery are automatically connected



1 D_o 1 Locomotive No. 7000. Side of Locomotive Removed

in parallel the moment the voltage of the generator attains the open-circuit voltage of the battery, *i.e.*, 51×2.03 V$=103.5$ V. The charging then proceeds according to the falling external characteristic of the generator at increasing pressure and diminishing current. If no lamp is in circuit while charging, the charging is stopped at 2.65 V per element, *i.e.*, at 135 V for the whole battery. If, however, one or more lamps are switched in, charging is stopped at 2.45 V per element, or 125 V. A charging-voltage relay in the switching apparatus disconnects the generator from the battery, and the lighting current is then supplied by the battery alone. When the battery is being charged and lighting current supplied at the same. time, a fixed resistance is included in the lighting-current circuit to choke the excess voltage before it can pass through the lamps. The battery does not then become so fully charged as during the day time. When the battery has once been charged and disconnected from the generator it is not automatically connected up in parallel again unless the set is stopped and then restarted. In normal service this usually occurs often enough, but if it does not, the generator and battery can be connected in parallel and the battery recharged by pressing a push-button in the switching apparatus. If the battery should become damaged and have to be cut out, by operating a change-over switch in the charging apparatus the generator can be connected up as a compound-wound machine. It then supplies the current for the lighting and control circuits on its own. In this case, since all the auxiliary circuits are connected up before the main locomotive switch, the contactor for the motor of the converter set, which is situated in the high-tension compartment, must be closed and interlocked when the current collectors are lowered. Then as soon as the pantographs are raised the converter set starts up and direct current is immediately available for operating the auxiliary apparatus. The great advantage of the charging apparatus type K is that it switches out the battery when it is fully charged and thus avoids all danger of overcharging.

All the electrical equipment has been provided with tropical insulation, and all parts which might suffer from dampness in the air have been specially treated. It was considered advisable to take these precautions, although the Japanese climate is only sub-tropical.

The locomotives weigh only 33 kg per horse-power at the motor shaft reckoned on the one-hour rating at 1500 V. They have thus the lightest weight per horsepower of all the existing direct-current narrow-gauge locoomotives of the J.G.R. and are, at the same time, the most powerful.

The 1 D_o 1 locomotives of the J.G.R. were shipped to Japan towards the end of 1925. They were on trial service from July to October 1926, and have been in regular service since October of the same year on the Tokio-Odawara section.

Particulars of the Clutches and Brakes of the "Golden Arrow" and the "Bluebird"

Designed and Supplied by Ferodo Ltd., Chapel-en-le-Frith, Derbyshire

The following particulars refer particularly to Major Seagrave's car, the "Golden Arrow" and in general to the "Bluebird" the car which is being driven by Captain Malcolm Campbell.

CLUTCH.—The preliminary designs were prepared by Ferodo Limited and submitted to Captain J. S. Irving, the Engineer responsible for the design and production of the car. After some small modifications had been made, the arrangement was adopted and the clutch was built and fitted. The design is of conventional multi-disc type, to transmit 900 HP at 3,000 RPM and a maximum torque effort of 1,500 lbs. ft. For this duty we considered it unnecessary to employ more than eight pairs of driving and driven surfaces; hence, the tremendous driving effort of the powerful Napier engine is transmitted through eight F.B.A. (Ferodo Bonded Asbestos) die-made linings $11\frac{7}{8}$ in. O.D. $8\frac{1}{4}$ in. I.D. $\frac{3}{16}$ in. thick, working against four hard steel plates $\frac{3}{32}$ in. thick. The circumferential tractive effort at the mean radius of the discs is very considerable, *i.e.* 3,600 lbs, so to prevent any possibility of the clutch failing to hold its load, the pressure on the linings was made 3,600 lbs applied through 18 springs spaced equally on a circle of the same diameter as the mean diameter of the linings.

An interesting feature is the use, probably for the first time, of vacuum servo mechanism, to assist the driver in opening the clutch—a very necessary power augment in view of the fact that a force of approximately 1,200 lbs is required from the release gear, and this effort is very much higher than can be conveniently arranged by pressure applied solely by the driver.

The unit pressure on the lining is 63 lbs per square inch, which is rather more than five times greater than is desirable for any ordinary clutch running up to 3,000 RPM. It is obvious that the dimensions of the clutch, as also the number of driving elements, are very small for the tremendous forces that have to be dealt with, but it was recognized that if change of speed was to be effected by changing gear at very high speed, it was essential that the inertia of the moving parts of the clutch should be kept as low as possible. Hence, the driving elements have been made small in diameter, and comparatively very light. At the same time, there is no question of their failing to support the duty, and since the clutch may work to 100 per cent. capacity for a few minutes in all, providing there is a margin of safety, however small it may be, the size and weight of the parts is really not material.

BRAKES.—Operating simultaneously on front and rear wheels they are of conventional design; each brake has two internal expanding rigid shoes, hinged on separate pins, and operated by pairs of symmetrical cams. The shoes are fitted with F. B. A. die-pressed lining, each lining being 2 in. wide and $19\frac{1}{8}$ in. long, embracing 100° of the circumference of the 17 in. diameter drums, giving a total area of 306 sq. inches and providing a ratio of 1 sq. inch of lining to 26 lbs of total car weight.

It is quite impossible to say what the speed of the car will be when the brakes are applied, and in what distance the car can be brought to rest safely—but the assumptions following may be of interest. If the car attains a speed of 240 MPH it will travel through 352 feet in one second, and if allowed to come to rest without using the brakes or using the engine as a brake, it would cover $4\frac{1}{4}$ miles in 2.125 minutes under the impulse of its own momentum. Assuming it could be stopped from a velocity of 352 ft per second in 30 seconds, it would travel one mile. In such case the rate of retardation would be 8 MPH per second, or 11.3 ft per second per second, which is equivalent to stopping from 30 MPH in 83 feet—not by any means a good performance in the ordinary way. Even so, the duty on the brakes would be very severe, as the dissipation of energy is at the rate of 700 HP.

As the area of lining is 306 sq. inches, the unit rate of work would be $2\frac{1}{4}$ HP per square inch, and the drums would rub against the lining at a mean velocity of 88 ft per second. Hence, in 30 seconds a total of two miles of brake drum surface would be in rubbing contact with the linings, at a pressure of 51 lbs per square inch, which would generate 15,000 British thermal units—a sufficient quantity of heat to raise 10 gallons of water from 70° F. to boiling point. The same quantity of heat, if there was no loss by radiation, would raise the temperature of the drums to 1,800° F. Therefore, radiation must be very rapid indeed, otherwise, the linings would be burnt out in a few seconds, with the possibility of the drums collapsing. These points, of course, have been considered, and no doubt Major Seagrave will be extremely careful in using the brakes, and will be satisfied to bring his machine to rest in a distance far beyond one mile.

The linings are F.B.A. die-pressed, fixed by brass rivets to forge steel shoes, and that they behaved very well in the preliminary trial is evidenced by the Press report that after stopping from a speed of 150 MPH the only apparent effect on the lining was the emission of a little smoke—so that the temperature in this case must have been well above 600°F.

The only difference between the clutch of Capt. Campbell's car and Major Seagrave's is that in the former there are 16 F.B.A. linings of the same diameter as those used in Major Seagrave's machine, with a correspondingly lower unit pressure.

Changing Conditions in Japan's Cotton Industry

THE Toyoda Cotton Spinning and Weaving Company's mills in Nagoya and Kariya are regarded as the most efficient in Japan, says the Special Correspondent of the "Manchester Guardian." An automatic loom invented by Mr. T. Toyoda has recently been put on the market as the outcome of long experiment, and the Toyoda Company hopes in time to see all the ordinary looms now in use in Japan replaced by this. The hope is based in particular on the cheapness of the Toyoda loom as compared with other automatic looms on the market, and also on its efficiency and rapidity of working. The manufacture of looms, the spinning of yarn, and the weaving of cloth are all carried on in Kariya, near Nagoya, by the same firm, where next door to the plant for loom manufacture there is a mill with 20,800 spindles and 1,004 automatic looms engaged on the production of coarse and medium cloth.

The looms are of the shuttle-changing type, but with no stoppage or slowing down of the machinery for the change of shuttle. The shuttles are in a magazine on the left ready threaded, and when the shuttle in operation becomes empty, or when the weft thread breaks, the loom ejects the empty shuttle and automatically replaces it by one of the shuttles in the magazine. There is no miss picks in connection with the change of shuttle. The speed at which the Toyoda loom can be economically worked is 200 to 210 picks a minute. This, combined with its low cost, is said to render it specially suitable for Japan, and there are already 12,000 in use in the big factories.

In the Kariya mill the 1,004 looms are all in two large sheds, one with 504 and the other with 500. The following cloth was being woven on the looms in the first shed when I inspected it :—

Counts		Dimensions		Weight	Picks	
Warp	Weft	Width inch	Length yards	lbs.	per inch	Reed
40	40	44	46	9.7	69.	50

In the second shed twill for the China market was being woven 30 inches wide of 20's warp and 22's weft, 66 picks to the inch. In the first shed the machines were going at the rate of 206 picks a minute and in the second at 210. I was told that each loom produced 46 yards per shift of 10 hours of the finer material and 50 yards of the twill.

There were slightly more operatives in the second shed than in the first, and the weavers appeared to be looking after from 20 to 40 looms each. It was, however, very difficult from a brief inspection to tell exactly how many machines were being worked by each girl, and I had perforce to accept the manager's statement as regards the division of labor, the number of machines attended to, and the earnings of the workers. These were said to be as follows for the first shed :—Nine weavers plus three substitutes, these twelve operatives piecing the warp and filling the shuttles ; eight girls for cutting the cloth when the beam comes to an end (as compared with twelve girls for piecing and filling the shuttles this sounds excessive, and it would seem that these eight must either assist the twelve or assist the men workers, probably the former) ; one man for carrying away and bringing the beams ; three men for fixing the beams ; one man for bringing and carrying away the bobbin boxes. In the second shed of 500 looms there were 25 weavers and the same number of substitutes and other workers as in the first shed, but here the yarn being used was made of very poor Indian cotton. There were, in addition, three adjusters for the two sheds on the day shift, but none at night.

The maximum number of looms which can be worked by one weaver is stated to be 60. The beginner starts on 10 to 12, and progresses until at the end of a year she can usually manage 50. Nevertheless the company tells intending buyers that 30 looms per girl is probably the most economical way of using the looms in view of the cheapness of labor in Japan and the fact that the number of adjusters required will be the same per 1,000 looms whether a girl works 30 or 50 of them. The work looks very strenuous, for the girls have to walk rapidly from loom to loom over a large floor space. The weaver earns on an average Y.48 a month on 50 looms, and Y.52 on 60. (It can be seen how little increase is given on 60 looms over 50.) She is on piece rates, and I was told that she got paid Y.001 per yard if working 50 looms on the 40's warp, 40's weft material. The other girls in the weaving shed are on a standard wage of Y.1.20 for the cutters and Y.1.10 for the substitutes. The men are earning from Y.1.25 to Y.1.45 a day. It must, however, be stated that the girls receive free lodging in the factory dormitories and food at a cost of only 10 sen a day to themselves. The management contributes a little more than 20 sen a day for their food. The weaver's wages on 50 (or 40) looms are no higher than those paid to a girl working six ordinary looms with an automatic warp stop motion, such as are commonly in use in the Japanese factories. They are actually only a little higher than those paid to a girl working four ordinary looms, which is the usual number per worker on plain cloth in Japan.

The cost of the Toyoda automatic loom is about Y.600 as against Y.300 for a Platt's loom and Y.200 for an ordinary loom of Japanese manufacture. These are the current prices in Japan as given by a representative of Mitsui Bussan Kaisha's engineering department. The total manufacturing cost of the 40's count cloth on the automatic looms is said to be between 90 and 92 sen per 46.5 yards. The spinning costs work out at about 3 sen a day per spindle spinning 20's, 22's, and 40's, that is an average of 30's. Figures furnished by one of the other big cotton companies for the manufacture of a very similar but slightly lighter cloth show a manufacturing cost of Y.1.68 per 44.5 yards and a somewhat smaller production per loom per 10 hours.

There are other automatic looms at work in Japan. The Kanegeftchi Company, for instance, have both Stafford and Arima automatic looms at work in a mill I visited just outside Tokyo city. But here there were 7.9 men and 11.3 women per 100 looms on the Stafford and 5.7 men and 17 women per 100 looms on the Arima automatic.

The above points give some idea of the great saving expected from the Toyoda loom. It must further be taken into consideration that inferior Indian and American cotton was being used in the Toyoda mill, and there can be little doubt that the use of better cotton would further substantially reduce the manufacturing cost. The reserve funds of most of the Japanese cotton spinning and weaving companies are very large, and if they become convinced that the saving to be effected by the use of the Toyoda loom is sufficiently great to warrant the expenditure they can easily afford to install them. Moreover, they are all preparing for the abolition of night work for women next July by increasing their spindleage and the number of their looms.

Although the invention has only been patented for three years there are already 12,000 in use in Japan, and the Toyoda works are employed at full capacity on a large number of orders. It is said by the Toyoda Company that the saving to be effected is so great and the cost so low for an automatic loom that, in spite of the cheapness of labor in Japan, manufacturers are finding it worth while to replace their ordinary looms. The Toyoda Company is now sending out the automatic looms to their mill in Shanghai, but there can be little doubt that this is mainly for advertisement. It is difficult to see how the looms can become an economical proposition in China, where a worker can be had for about 1s. for a 12-hour day.

Telephones in Korea

THE first telephone service was undertaken in 1902 between Keijo and Jinsen, and subscribers numbered only 65. In 1903 an exchange service at Fusan was started, and the number of subscribers increased from 310 at the end of that year to over 1,000 at the time of the postal union with Japan (1905). At that time only 16 lines were in operation, but expansion was rapidly pursued, and a long-distance line between Keijo and Heijo was opened in 1907, and one between Keijo and Fusan in 1911. Also in 1921 direct connection between Keijo and Mokpo, and Keijo and Gensan was effected, and the 828 lines in operation in 1911 were increased to the large number of 6,825 in 1925, inclusive of 157 long-distance ones. In the following table certain details are given of the telephone service.

	Number of Telephone Offices for Exchange and Messages	Number of Telephone Offices for Messages	Number of Telephone Subscribers	Number of Calls during the Year
1905	5	1	1,065	8,489,530
1910	32	185	6,448	21,260,918
1919	46	484	11,788	58,691,425
1920	49	480	13,142	59,974,020
1923	81	483	21,776	85,341,678
1924	95	500	24,483	101,159,830
1925	104	506	26,265	114,510,002

China Makes Way for the Motor

By a Viola Smith, U.S. Trade Commissioner, Shanghai, China

THE greatest array of workers in China since the building of the Great Wall is now building roads in Kweichow Province. Two hundred thousand soliders, farmers, tradesmen, school children—boys and girls—have been put at this work by Chow Hsi-tsun, a young military leader of an adjoining province who was invited to Kweichow on promise of substantial support if he succeeded in restoring peace and prosperity.

Not long ago the first motor car reached the provincial capital after a 50-day journey from Canton, being transported in pieces on coolies' backs over mountain ranges when water transportation ended. The province was bandit-infested and famine-stricken.

In a few months Governor Chow made the profession of banditry unprofitable and set about seeking constructive opportunities for the people of his province.

Kweichow is an inland province in southwest China. Narrow tracker trails over steep mountain passes provided its only contact with the world. Over these trails a coolie tracker could transport $400 (Mexican) worth of opium with no more labor than it took to carry $3 or $4 (Mexican) worth of rice or other produce.

Opium traffic flourished ; other trade was demoralized. Seeking a method to correct this condition, Governor Chow hit upon better means of transportation. He sought technical advice on road building.

Within two years 600 miles of road have been built. The Tsunyi-Chiuhi section of the system in the extreme northwest tip of the province will connect with a small tributary of the Yangtze River. Steam launches connecting with river boats at Chungking will provide a river transportation outlet for the products of this isloated province for the first time in history.

But Kweichow is not the only province that has awakened to the need of better transportation. All over China, provinces and districts are constructing highways. Today between 10,000 and 13,000 miles of graded dirt roads are opening up many areas to modern means of transportation. Hard surfacing has been done in but a few districts outside the foreign concessions in the larger treaty ports.

Construction is more or less sporadic as there is no national system of highways. Although historians credit the Chinese with having an elaborate and well-maintained post or courier system a thousand years earlier than the Romans, her ancient system of imperial roads, comprising some 2,000 miles of narrow dirt traffic tracks, finds no counterpart in the modern road development. The longest regular motor route in China, from Kalgan to Urga, is 800 miles long.

But the fact that China has been able to make any progress in roads during the recent upheavals is phenomenal and the awakening of provincial authorities to the beneficial results of highway construction is one of the encouraging highlights on the China horizon.

In Kwangsi province immediately south of Kweichow, more than 1,000 miles of roads have been built within two years, with work rapidly progressing on other lines connecting the principal centers of Nanking, Liuchowfu, and Wuchow. Highway construction if further exhilarated by plans for an Industrial Exposition at Wuchow next October, in which Kwangsi Province invites foreign traders to participate and learn for themselves what has been accomplished. Kwangtung Province, where Canton is located, has been engaged in road building, though not so extensively as its neighbors.

Chekiang Province on the central eastern seaboard is by far the most progressive in all China. Despite civil warfare within its borders, Chekiang has steadfastly held to its roadbuilding plans started several years ago. So determined are the provincial authorities that road building must continue that they refused to join in the revenue scheme of the Central Government at Nanking, until assured that the $1,200,000 (Mexican) cigarette tax for roadbuilding would not be disturbed. As a result, the Nanking Government is monthly allotting $100,000 (Mexican) (Gold $50,000) to the Chekiang provincial road bureau for highway work.

New Roads for Old Walls

Modern roads have replaced ancient city walls at Canton, Shanghai, Nantungchow, Hangchow, Changsha, Yunnanfu, Chuanchow, and Waichow, while in other centers such as Kiukiang, Nanchang, Yangchow, Kashing, Pinghu, Soochow and Wuchow—walls are being destroyed. Numerous others are scheduled to be scrapped as road building programs progress.

More amazing still is the removal of graves, notably in Chekiang and Szechuan provinces. For centuries, graves have been so sacred that modern building and transportation projects have often suffered. To-day in certain progressive districts one sees the actual removal of graves to make way for roadbuilding. A " constructive revolution" is proceeding in the face of military depredations.

It is difficult to say when better roads were first debated in China. The original advocate seems to have been Lo Kou-Shuiî who, while serving as technical secretary and adviser to the Ministry of Communications in 1913, urged adoption of a highway program as a complement ot the construction of a national system of railways then being drawn up.

Although he was years ahead of his time, his constant urging resulted in a presidential mandate November 15, 1919, stipulating certain regulations for the construction of new roads. Unfortunately this amounted to little more than a paper transaction so far as any real impetus for the creation of a national highway system was concerned.

The road building program initiated in 1920 under the direction of the American Red Cross to assist famine stricken districts was undoubtedly the first real impetus for modern roads. This stimulus, caught by a Sino-American group of individuals, resulted in the formation at Shanghai in May, 1921, of the " National Good Roads Association of China."

This organization, popularly known as the " Good Roads-Movement," has played a considerable part in educational propaganda for " better roads." Its " Good Roads Monthly" published in Chinese since March, 1922, claims a circulation of 8,000. One thousand copies of a voluminous work in Chinese entitled " A Book on Roads" have been compiled, published and circulated. Special pamphlets and other material have likewise been issued in the Chinese language and disseminated throughout the country.

The Association further claims a measure of success in inducing the organization of private motor bus transportation services, and also claims to have urged the Ministry of the Interior to bring pressure to bear on provincial officers to establish highway bureaus. Many provinces have created such bureaus, while in others they are being organized. In five of these, Kiangsu, Kiangsi, Hupeh, Hunan and Honan, the highway bureaus have regular budgets and annual programs in operation. In a few districts such as Nantung, Shanghai, Paoshan, Changsoh, and Taichon, " District Road Bureaus" have been instituted to build and maintain city and country roads.

On the practical side, however, the China International Famine Relief Commission has undoubtedly done more in recent years than any other single medium in the actual construction and extension of road building in China. Since 1923 it has been responsible for the administration of several million dollars on reclamation, dike and road construction work.

In many places it has been able to carry on constuction projects irrespective of military operations and the instability of local governments. It aims to have the local authorities with whom it is co-operating match the China International Famine Relief money spent on given projects, either with funds or the equivalent monetary value in labor and materials. This method relieves the sting of philanthropy and inculcates in its place a sense of responsibility in the local authorities who sponsor the work.

The Nanking Nationalist Government, though it has set up no national highway bureau, has urged on the provinces, through its Reconstruction Commission, the desirability of creating provincial highway bureaus for the immediate construction of highway systems.

Various district road bureaus throughout the provinces have held conferences at provincial capitals.

Such a conference was held in May at Nanking by the Kiangsu provincial authorities ; and another was held in the same month at Wuhu, Anhwei Province. The National Communications Conference held in August endorsed better roads and proposed immediate building of a highway from Nanking to Peking.

For use on these roads, China, a country larger in area than the United States with four times its population, has less than 25,000 motor cars, contrasted with the 23,000,000 cars in America.

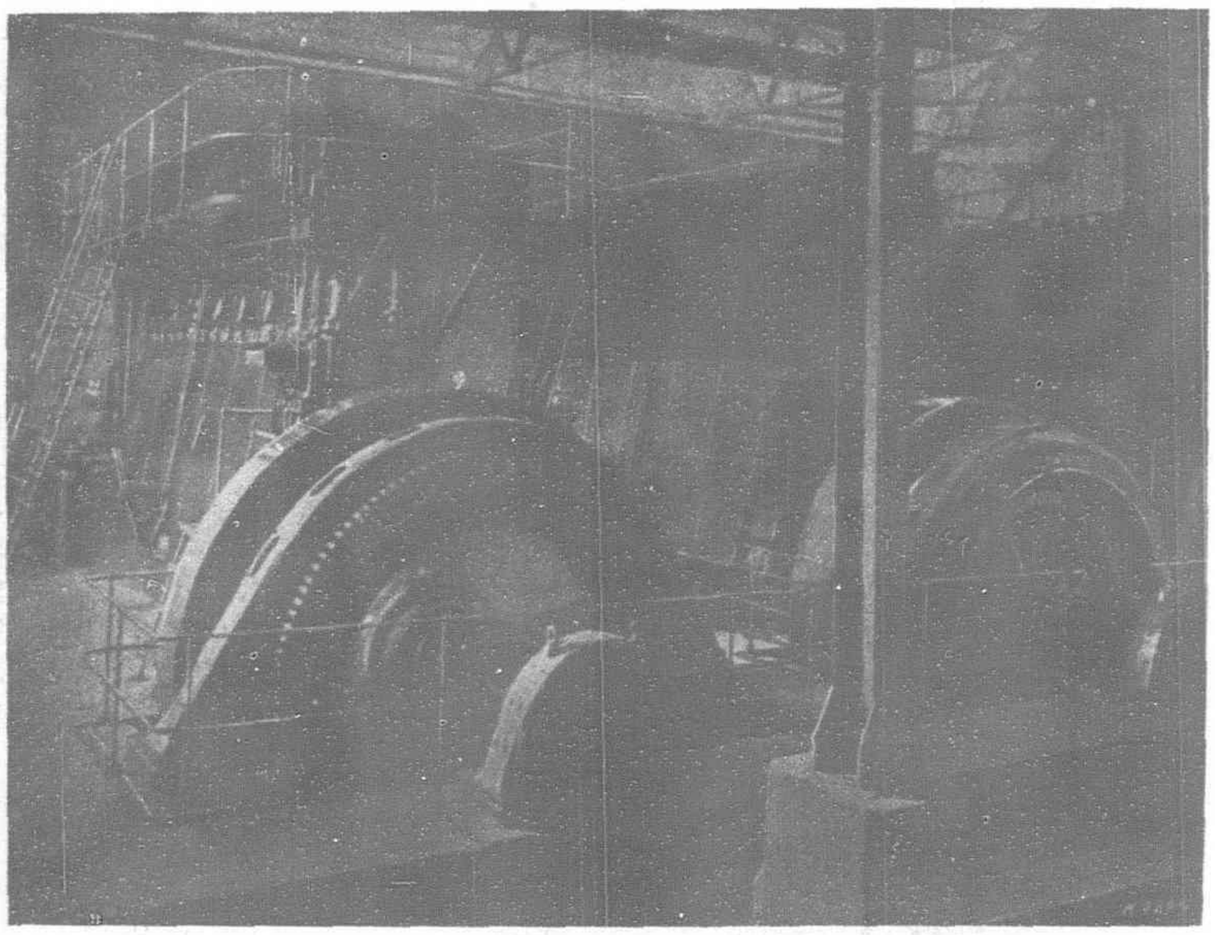
In 1926 the Good Roads Association reported 26 bus companies in operation. Many others were inaugurated in 1927 and 1928.

China has an abundance of cheap labor which mitigates against rapid introduction of modern highway construction machinery. Similarly her dirt graded roads will not stand heavy traffic, but the opening of any kind of modern roads is the significant thing to be stressed in looking toward the development for equipment five years hence.

A. E. G. Diesel Plants in Asia, 1928

THE A.E.G. of Berlin have kept pace with Diesel engine development and erected numerous plants in foreign countries during the past few years. Special precautions have been taken in designing Diesel-Generating sets for tropical climates, unusually high altitudes and other climatic conditions. Amongst the A.E.G. Diesel plants supplied to Asiatic countries the power plant of the Ampang tin mine in the Federated Malay States operated by the Yukon Gold Company, an American concern, is of particular interest, owing to its location about three degrees north of the equator and to the special climatic conditions under which it operates.

The order for the Diesel engines was placed with the Italian firm of Franco Tori. These consisted of three 6-cylinder, four



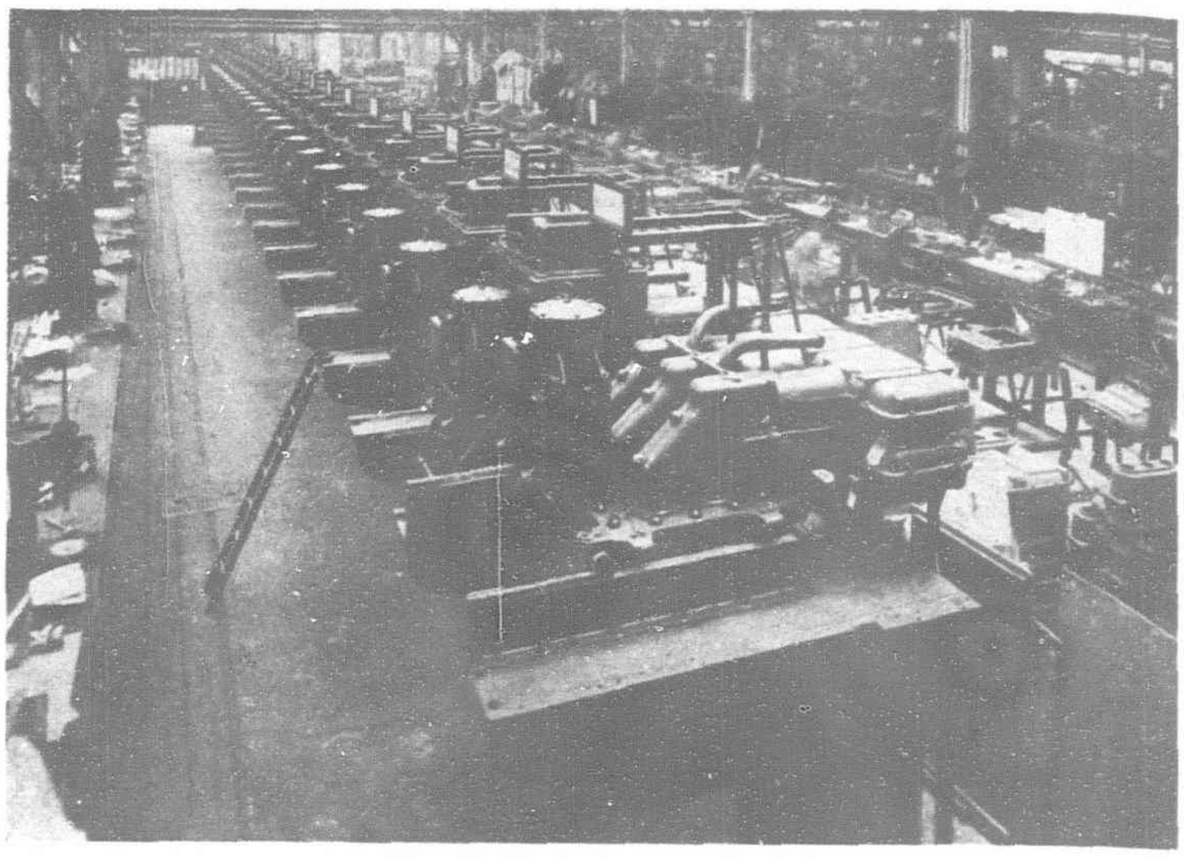
Ampang Diesel Power Station (Federated Malay States)

stroke Diesels, each to develop 600 h.p. at 180 r.p.m. The A.E.G. was awarded the contract for the three 3-phase generators of 500 k.v.a., 4,400 volts at 60 cycles and 0.8 power factor. It is intended that these machines shall subsequently run at 50 cycles, for which purpose the speed will have to be reduced to 150 r.p.m. and the output to 500 h.p. or 420 k.v.a.

The illustration shows these Diesel sets in operation and the iron construction of the sheet iron power house. Another interested A.E.G. Diesel generating set consisting of one outer field rotating type generator of 850 k.v.a. 3,500 volts, 225 r.p.m., 60 cycles and 0.70 power factor for coupling to a M.A.N. Diesel engine was supplied to the Mitsubishi Mining Company of Tokyo.

British Switchgear for Shanghai

A LARGE metal-clad switchboard for the Shanghai Municipal Electricity Department, despatched recently from the works of Messrs. A. Reyrolle and Company, Limited, of Hebburn-on-Tyne, England, weighed 125 tons, and was conveyed to Birkenhead in a special train of 25 trucks. The order was secured against international competition, and forms part of the



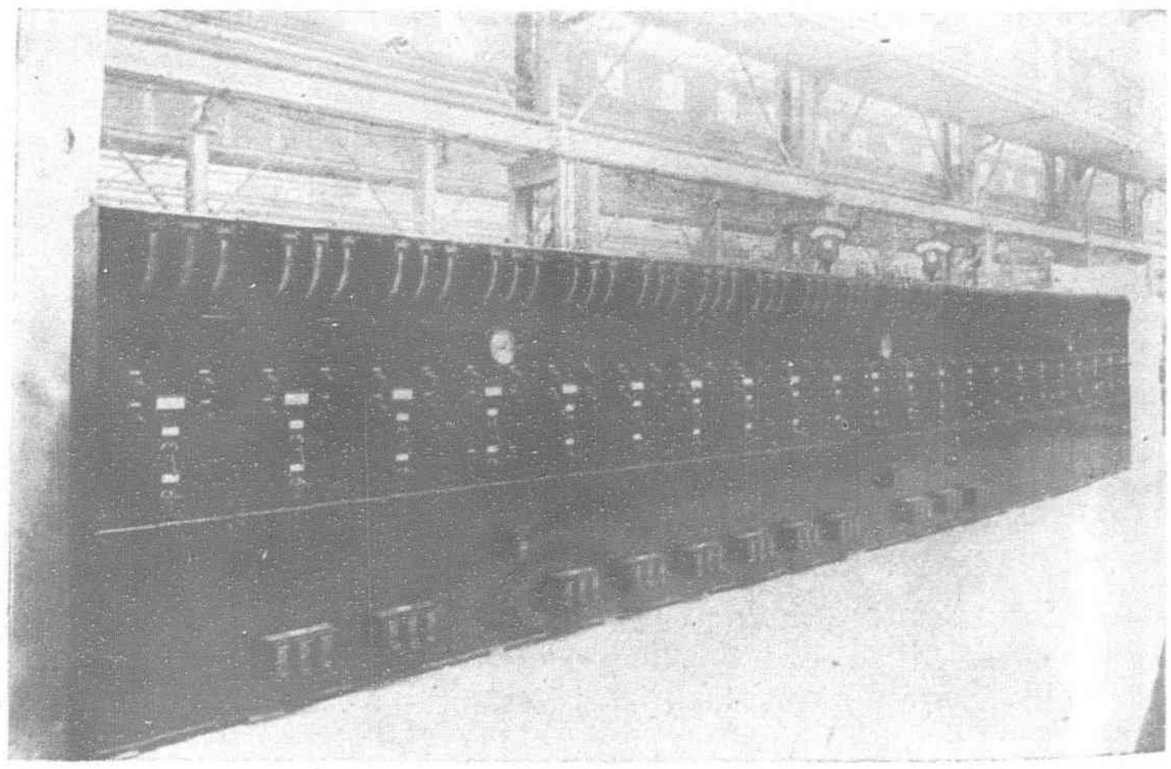
Metal Clad Switch Board

scheme whereby Shanghai is extending and strengthening its switchgear connections. Brennan Road Substation constitutes an important link as a main substation on the system, and with a total generating plant of 161,000 kw. at Riverside, the switchboard will have a very important duty to perform.

This product of Tyneside, England, is built up of units of Reyrolle's well-known duplicate-bus-bar " A2 " type, furnished with certain special features to comply with the operating conditions: for example, oil-immersed bus-bar change-over selector switches mounted over the circuit-breakers proper. These enable the load of any circuit to be transferred from one bus-bar to the other without interrupting the supply, and in order to ensure that the bus-bars are in step prior to the change-over, the bus-bar coupler switch is interlocked with the circuit controlling the motors provided for operating the bus-bar selector switches, in such a way that unless the bus-bar coupler is closed, electric operation of the selector switches cannot take place.

As is usual in this switchgear, the interlocks protect against inadvertent operation, and they include one that makes it impossible to move the circuit-breaker portion when the selector switch is in an intermediate position, notwithstanding that this condition could only arise if the switches had been operated by hand after withdrawal.

One feeder is of the split-conductor type, and the others have Merz-Price pilot-wire protection. Two have been fitted with Reyrolle's split-pilot system.



Control Board for Operating Switchboard

Engineering Notes

ELECTRIC LIGHT, POWER AND TRACTION

KYOTO MUNICIPALIZES ELECTRICAL ENTERPRISE.—Mayor Toki of Kyoto city and Mr. Tanaka, president of the Kyoto Electric Light Company, came to an agreement as regards the municipalization of the electric light and power enterprises in the city.

The negotiations, which were opened during April, have so far made smooth progress, and they agreed upon main points of the Kyoto city's proposal a few days ago. At this interview between the Mayor and the President of the Company, the price at which the Municipality is to take over part of the company's enterprise was agreed upon. In the course of the coming few days, they will talk on minor points of the proposal, such as the question of procedure of the municipalization, and then, a provisional contract will be signed.

The enterprise of the Kyoto Electric Light Company which Kyoto city is going to take over consists of the electric lights supply numbering 542,300 pieces, power supply amounting to 35,000 h.p., and 10,000 k.w., of power for electric heaters.

SHINANOGAWA DENKI K.K. (Shinanogawa Electric Co., Ltd.)—The Togiigawa Hydro-Electric Power Station, automatic, of this company has been improved recently by installing an additional unit of 2,900 h.p. water turbine, dyanamo of 2,500 kva, 66,000 v., 60 cycle. The new equipment is going very nicely, it is reported. The maker is Shibaura Seisakujo.

TOKYO DENTO K.K. (Tokyo Electric Light Co., Ltd.)—Tokyo Dento has decided to buy two electric power companies: One Katsuragawa Denki Kogyo K.K. (Katsuragawa Electric Development Co., Ltd.), capital Yen 2,000,000, Yen 1,000,000 paid in, and the other Fuefuki Suiden K.K. (Fuefuki Hydro-electric Co., Ltd.), capital Yen 1,250,000, all paid in.

The purchase price of the latter company is not yet known. For Katsuragawa Denki Kogyo, Tokyo Dento will hand over Yen 1,340,000 shares owned by Toden Shoken K.K. (Other details unknown).

RAILWAYS

TWO BRANCH LINES IN MUKDEN COMPLETED. The Peking-Mukden railway has recently completed two short branch lines in the vicinity of Mukden. One goes to the Pei Lin, Northern Imperial Tombs and the other to the Tung Ling, or Eastern Imperial Tombs, the intention being to facilitate communication to these beautiful and interesting spots.

The line to the Pei Ling has already been opened for traffic, elaborate ceremonies marking the opening day.

The opening of the line to the Tung Ling has met with unexpected delay. The line passes through the grounds of the North Eastern University and for reasons not known the students objected to its presence. A body of them, therefore, proceeded to tear up a section of the track. Negotiations between the university heads and the railway authorities are now procceding.

CONSTRUCTION OF FORESTRY RAILWAY LINE.—Having decided to establish a forestry railway line at an estimate of 1,800,000 spread over three years, the Forestry Department of the Chosen Government-General will start the first stage of the line, 18 miles in length, about the middle of June next at the cost of Yen 700,000. It is understood the entire length of the line will be 40 miles, of which 18 miles will be completed in 1930 and the remainder in 1931. On completion the line will have a transport capacity of 200,000 *shakuime* of timber a year.

CONSTRUCTION OF LIGHT RAILWAY BETWEEN KHUNCHUN AND TOMEN.—Acting upon the twelve-year plan for construction of the Tomen East Railway Line, connecting Yuki with Tung Kwanchen 97 miles in length, work on the section between Yuki and Shinazau was started in October the year before last and is expected to connect with the Tomen West Line in 1931. Khunchun Prefecture of Kirin Province, on the far side of the Tomen, is 260 square *ri* in area and with a population of 80,000 annually produces over 400,000 *koku* of grain. About 50 per cent. of the population is Korean and trade through Hsia Juping, Keigen and Ryudo, is yearly on the increase, the total last year exceeding Yen 3,000,000 or 90 per cent. of the total amount of trade. The lack of means of communication save by the Rivers Tomen and Khunchun is the great obstacle to the gathering and distribution of its products, so completion of the Tomen railway line will put a new face on affairs, so attention is being paid by the Chinese authorities as to the location of a new station to be established by the Railway Bureau on the Tomen. On the other hand a plan is on foot for construction of a light railway line from Khunchun to Tomen, and the promoters are now approaching the Kirin Provincial authorities for permission. There are at present three plans, 1. From Khunchun to Hsunchieh via Yung Wantze, 2. From Khunchun to Keigen via Shatotze, Ryuta Island, Jyosen, 3. From Khunchun to Ryudo via Hokuang. Viewed from the stand-point of physical features, construction of the first line is the easiest but lack of means of communcication between Hsunchieh and Keigen is against it so the second one bids fair to be adopted.

NEW TSITSIHAR-KOSHAN LINE.—As previously reported, the Tsitsihar government, in order to raise sufficient private capital for laying the new Tsitsihar-Koshan line with, announced some time ago to the people of Koshan and Paichuan Prefectures that whichever Prefecture would put up $300,000 ahead of the other for the construction costs should be privileged to get the main line built in that Prefecture.

THE PROPOSED HANGCHOW-KIANGSHAN LINE.—A project for the construction of a short railway line in Chekiang linking Hangchow, the Provincial capital, with Kiangshan, in the southwestern corner of the Province, has been prepared by Mr. Chang Ching-kiang. Chairman of the National Reconstruction Committee and concurrently Chairman of the Chekiang Provincial Government, for submission to the National Reconstruction Committee. The cost of construction of the proposed railway will be borne entirely by the Chekiang Provincial Government, but the construction will be supervised by the National Reconstruction Committee.

RECONNAISSANCE PARTIES ON WAY TO YUNNAN.—Two reconnaissance parties are being sent out by the Ministry of Railways—one for the proposed Yunnan-Changsha line headed by Chou Liang-ching, and the other for the proposed Yunnan-Canton line headed by Li Yao-ching. Mr. Chou is a technical expert of the Ministry and has been with the Paotao-Ninghsia Railway.

HANGCHOW-NANCHANG, HANGCHOW FOOCHOW AND HANGCHOW-ANKING LINES PROPOSED.—The Province of Chekiang will be laying down tracks for three inter-provincial railways with Hangchow as the central point, if plans completed by Mr. Cheng Ching-chun, Provincial Commissioner of Reconstruction, can be carried out. The proposed lines will be the Hangchow-Nanchang, Hangchow-Foochow and Hangchow-Anking lines. The project is now under consideration by the Chekiang Provincial Authorities and will be submitted to the State Council for sanction.

NEW TSITSIHAR-KOSHAN LINE.—Regarding the construction of the Tsitsihar-Koshan Line, North Manchuria, the earthwork has been finished up to Taianchen, while the rail-laying work has been pushed as far north as three miles from Tahaerhchan. At present, 100 men are put on the construction of a wooden bridge over the Wukoerh river.

FUJI SANROKU ELECTRIC RAILWAY COMPANY CONNECTS OTSUKI AND YOSHIDA-GUCHI.—The opening took place at Yoshida, Fuji on June 23, of the most modern rapid transit railway in Japan laid between the Otuski Station on the Chuo Line of the Government Railways and Yoshida-guchi at the foot of Mount Fuji, by the Fuji Sanroku Electric Railway Company, Limited, which was formed with the object of exploiting the great scenic resources which lie on the skirts of Fuji, hinging around Fuji's five lakes.

LUNGHAI RAILWAY PURCHASES.—It is officially announced at the Ministry of Railways to-day that an amount totalling £349,625, from the Belgian Boxer Indemnity Fund, has been spent by the Lunghai, Railway for the purchase of cars, locomotives and other railway materials. The amount which had been allotted to the railway from the Belgian Boxer Indemnity Fund was £370,487, thus leaving a balance of approximately £20,862 which amount will probably be used for purchasing rails and other materials for the western section of the railways. The purchases made are as follow :—

First class and second class cars, dining cars and sleepers	£40,284
Freight cars	4,190
Railway bridges	14,820
Steel Sleepers	30,432
Railway bridges	28,200
Rails	108,620
Water Feeders	4,490
Telephones	305
Dining car and sleeper equipment ...	2,440
Pipes	650
Miscellaneous materials	12,300
Locomotives	73,000
Miscellaneous materials	15,700
Miscellaneous materials	14,400

MORE UNDERGROUND RAILWAYS PLANNED.—The steady increase in the city population is now an important factor which encourages reorganization of traffic system. At present there is only one underground railway which is operating; Tokyo Chika Tetsude K.K. (Tokyo Underground Railway Co., Ltd.) in Tokyo—between Asakusa and Ueno, but there are several plans now under way: Osaka Municipal Underground Railway, Tokyo Municipal Underground Railway, a new plan to connect Aichi Denki Tetsudo and Nagoya Tetsudo by a subway in Nagoya.

In addition to these, two new plans are reported, one in Kobe and the other in Nagoya. The necessary license has been applied for already, and the Department of Railways is likely to grant it, considering the future development of traffic in big cities.

The Kobe Underground Railway Co., Ltd. (Kobe Chika Tetsudo K.K.) now being promoted is to be capitalised at Yen 29,000,000. The mileage is 7 miles 45 chains, between Nishi Suma and Sumiyoshi Machi and between Nishi Sume and Fukiaigawa. Prometers include Mr. Gisaku Takikawa and 12 other noted businessmen.

The Nagoya Chika Tetsudo K.K. (Nagoya Underground Railway Co., Ltd.) is to have a capital of Yen 12,000,000; section, Atsuta Machi to Sasajima Machi, Nagoya, 44 miles. Promoters are: Jusuke Tomita, Kiyonari Ayukawa, etc. (For more data on this company, see Our Service No. 506, dated May 21, 1929). (Taken from Denki Nippo).

PROJECTED KALGAN-DOLONOR RAILWAY.—Construction work on the long-projected railway between Kalgan and Dolonor will commence in six months. The total mileage of the line is four hundred *li*, about 133 miles and the entire cost is estimated at about $4,000,000. Labour from the famine-stricken district will be used for the building of the line.

CONVERSION OF ARMORED TRAIN INTO PASSENGER CARS.—The Ministry of Railways has requested the Military authorities to allow the Ministry to convert the armored cars and armored locomotives formerly used for military transport on the Kiukiang-Nanchang Railway into regular passenger and freight cars and service locomotives respectively for ordinary traffic. It is learned that steps are being taken by the Military authorities to comply with the request.

INSPECTION TRIP MADE.—Mr. H. S. Chuck, Managing Director and Chief Engineer for the unfinished portion of the Canton-Hankow Railway, arrived in Nanking this week to report on his inspection trip over the proposed route linking up Chuchow (in Hunan) with Shiuchow (in Kwangtung province). Mr. Chuck was accompanied by Mr. J. Weir, Consulting Engineer to the Ministry. After reporting and conferring with Minister Sun Fo, Mr. Chuck left Nanking yesterday for Canton, where he will arrange to start construction of the first 31-mile section of the line from the northern terminus of the Kwangtung end. The estimated cost for building and equipping this section will be approximately $7,000,000, and noteworthy engineering features include a bridge of seven spans with a total length of 760 feet at Shiukwan, and a 1,400 feet tunned at Kaolin, which is about half-finished. Piers and abutments for the bridge have already been completed.

TSUKUBA KOSOKUDO DENKI TETSUDO K.K. (Tsukuba High Speed Electric Railway Co., Ltd.)—License has just been granted for a new line from Umejima Mura, Minami Adachi Gun, Tokyo Prefecture, and Matsudo Machi, Minami Katsushika Gun, Chiba Prefecture, covering a distance of some 7 miles 38 chains. The cost of construction is estimated at Yen 2,150,000 for the entire section.

OSAKA SUBURBAN RAILWAYS PLAN CONNECTION WITH OSAKA MUNICIPAL UNDERGROUND RAILWAY LINES.—All suburban railways in Osaka are planning for connection with the new underground railway lines to be constructed by the Osaka Municipality, the first section running from south to north through the heart of the city to be started before the end of this year.

Osaka Denki Kido K.K. (Osaka Electric Tramway Co., Ltd.) which is operating an electric railway between Osaka and Nara, has applied for a license for one mile of high speed electric railway from the present terminus at 6-chome, Uehon Machi to Nanba via Sennichimae.

In February this year Nankai Tetsudo K.K. (Nankai Railway Co., Ltd.) also applied for license between Ebisu Machi to Nanba via Sakaesuji and Nihonbashi, about one mile, underground line.

On May 24 Keihan Denki Tetsudo K.K. (Keihan Electric Railway Co., Ltd.) applied for the necessary permission for some half-mile underground line from the terminus at Tenmabashi to Tenjinbaahi. This line is to be connected with the second section of the Municipal Line which is to start from Noye and terminate at Tennoji Park via Umeda Kushin Machi, Tenmabashi, Matsuyacho Suji. The cost of construction for this plan of Keihan is estimated at some Yen 4,000,000.

As for other railway companies, Hanshin Kyuko Dentetsu K.K. (Hanshin Express Electric Railway Co., Ltd.) and Hanshin Denki Tetsudo K.K. (Hanshin Electric Railway Co., Ltd.) are to connect with the Municipal underground line in front of the present Osaka Station, while the Osaka Tetsudo (Osaka Railway Co., Ltd.) will also get connected directly with new subway lines. Keihan was the last to apply for underground connection, so that every private railway in Osaka is to be connected with the Municipal line.

INDUSTRIAL

NIPPON SEKIYU K.K. (Japan Petroleum Co., Ltd.)—The company has decided to prospect for oil at Gyunikuzaki, Banshasho, Shinyei Gun, Tainan Province, Formosa. Some time ago the company succeeded at Rokujukei fields in the neighborhood of Gyunikuzaki, so that the present attempt is expected to be successful. Prospecting operations will be started on August 10, this year.

NEW GAS COMPANIES LICENSED.—The Department of Commerce and Industry has just granted license for the following two concerns :

Sakaide Gasu K.K. (Sakaide Gas Co., Ltd.) in Kagawa Pref. Authorized Capital, Yen 150,-000. Cost of construction estimated at Yen 145,000. Supply District, Sakaide Machi, in Kagawa Prefecture, where the number of customers is estimated at 900. Productive capacity of the plant is rated at 1,400 cubic meters a day. The rate of charges will be 14 sen per cubic meter.

Seto Gasu K.K. (Seto Gas Co., Ltd.) in Aichi Prefecture. Authorized capital, Yen 500,-000. Cost of construction estimated at Yen 200,000. Supply district, to cover the whole town of Seto, in Aichi Prefecture, where the number of customers is estimated at 1,200. Capacity of the plant is rated at 1,700 cubic meters a day, and the rate of charges at 14.1 sen per cubic meter.

The chief promoter of Sakaide Gasu K.K. is Gisaburo Kanazawa, that of Seto Gasu Monyemon Kato.

THREE MOTOR CAR COMPANIES TO CO-OPERATE.—Three Japanese motor car manufacturers are reported in negotiation for production and sales agreement. The plan is encouraged by the Department of War, especially, in view of marked activities on the part of foreign manufacturers in Japan. The three concerns are as follows :

Ishikawajima Jidosha Seizo K.K. (Ishikawajima Motor Car Mfg Co., Ltd., recently established to take over the motor car department of Tokyo Ishikawajima Zosenho, K.K. details, see our "Japan's Reviving Industries, page 305). Capital of this concern is Yen 2,500,000, productive capacity about 350 cars a year, including motor trucks and autos, busses.

Tokyo Gasu Denki Kogyo K.K. (Tokyo Gas and Electric Industry Co., Ltd.)—details, see our "Japan's Reviving Industries," page 301, with a productive capacity of 50 cars a year, principally large size busses.

Datto Jidosha K.K. (Datto Motor Car Co., Ltd.), which has a capital of Yen 500,000, and a productive capacity of 50 cars of small size busses.

At present the government is subsidizing this industry to the extent of Yen 500,000 a year.

The agreement now under negotiation is to cover buying of materials, standardization of the type of cars, and sales by discriminating sphere of influence. It is reported that these firms will endeavor to manufacture motor trucks and busses the demand of which is rising every year, the present proportion being about 30 per cent. of the total demanded in Japan a year, 20,000 cars.

STEEL WORKS FOR NEW WIJU.—The proposed establishment of a steel manufactory at New Wiju has made good headway.

On the prospective detachment of the Anzan Iron and Steel Works from the S. M. R. Co. into a separate company, a steel works on the capital of Yen 70,000,000 will be established at New Wiju with a blast furnace of the capacity of 2,500 tons. Then the pig iron and semi-steel materials put out at the Anzan Works will be wrought upon. To facilitate the shipment of the products of the new works, the harbour of Liutaokou, Antung, will be reconstructed at the outlay of Yen 6,000,000.

In order to obtain more materials for the new works , the S.M.R. Co. has approached the Kenjiho Iron Works owned by the Mitsubishis and the Penchihu Mining and Colliery Co. for co-operation, according to a report.

S.M.R. TO FORM TWO IRON AND STEEL PLANTS.—Among the aggressive plan of unifying the pig iron and steel industry under the management of the S.M.R. with capital of Yen 100,000,000 (which is regarded as most conspicuous of many other proposals for industrial activities), the one most talked about is to establish an iron works at Shin-Gishyu, Chosen, in addition to one already working at Anshan, with capital of about Yen 70,000,000, and the other is the proposal of establishing a sister iron works of the one at Anshan in Japan Proper, in close alliance with the Asano and Matsukata interests. President Yamamoto of the S.M.R. is determined to realize both of these plans within several months.

Vice-Admiral Takuo Godo who was entrusted with the purchase of necessary machinery for the pig iron and steel works from the Krupps in Germany returned to Anshan on May 13 with machinery worth Yen 5,000,000. He and President Yamamoto are expected to promote the plan of the unification of the iron and steel industry.

If the S.M.R. is to undertake, as proposed, other industrial enterprises including extensive manufactures of soda and sulphate of ammonia and others, the S.M.R. will need at least new funds amounting to Yen 350,000,000 until the whole scheme is completed, and the question of increasing the capital of the S.M.R. is expected to come up within a year or two.

Mr. Matsuoka, Vice-President of the S.M.R. called on Premier Tanaka in Tokyo and obtained the Premier's agreement in regard to the replacing of the Board of Directors by a Board of Consulting Members. Arrangements have been made that when the S.M.R. files a formal application for permission, it will be readily granted.

BAN PLACED ON YELLOW PHOSPHOROUS MATCHES.—The manufacture of yellow phosphorus matches being detrimental to the health of workers in match factories, its prohibitation is to be strictly enforced by the Ministry of Industry, Commerce and Labor, according to a decision of the Executive Yuan to-day. An order prohibiting the manufacture of such matches was issued in 1926 by the former Government at Peiping, but has been allowed to lapse hitherto. The measure was originally adopted at an International Conference, and China, among other countries, formally subscribed to the agreement in 1923. That in accordance with a communication from the Ministry of Industry, Commerce and Labor, transmitting an official communication from the Hunan Provincial Government, the use of phosphorous, which is detrimental to the health of workmen employed in match factories—having been repeatedly prohibited by international conventions, to which the Chinese Government declared its formal adherence in 1923, and which the defunct Peking Government also prohibited by mandate in 1925—be again prohibited and suppressed within a specified time, by re-issuing the formal mandate, inasmuch as its use in industries seriously concerns the international relations of China and endangers the health of the workers. As regards matches made of phosphorous sulphide, which is not poisonous in its properties and the use of which other governments have not prohibited, the question as to whether it should be prohibited be decided later when appropriate measures have been studied and determined.

TELEPHONE, TELEGRAPH AND RADIO

AUTOMATIC TELEPHONES IN SINGAPORE.—Speaking at the thirty-fifth ordinary general meeting of the Oriental Telephone and Electric Co., Ltd., the Chairman said the work of installing the new automatic exchange equipment at Singapore is well in hand. The buildings have been completed, and the first instalments of the apparatus have arrived.

So that, unless any unforeseen contingencies arise, the new exchange should be in full working order shortly after the close of this year, and Singapore will then be in possession of the latest and most modern type of public telephone exchange.

MINISTRY OF COMMUNICATIONS TO CONTROL RADIO SERVICES.—All affairs pertaining to the Government's administration of radio services in the country are to be controlled by the Ministry of Communications instead of by the National Reconstruction Committee as has been the practice recently, according to a decision reached at the fourth session of the General Meeting of the Central Executive Committee on June 17. Measures for the transfer of the control of wireless will be formulated by the Executive Yuan for enforcement.

COMMUNICATIONS MINISTRY PLANS REDISTRIBUTION OF RADIO STATIONS.—The Ministry of Communications will take over the completed part of the radio contracts concluded by the Reconstruction Committee, according to the Director-General of Communications, Mr. Chuan Chun-wen.

It may be recalled that Mr. Chang Ching-kiang, chairman of the Reconstruction Committee, signed on November 3, 1928, a contract with the Radio Corporation of America providing that the American Company would furnish G.$170,000 worth of equipment for a wireless station in Shanghai.

The Reconstruction Committee later signed a contract with the Telefunken interests of Germany which provided for the construction by the latter interests of four one-kilowatt automatic short-wave wireless stations in China. Two traffic agreements were also signed by the Reconstruction Committee with the Radio Corporation of America and the German interests "Trans-Radio."

Mr. Chuan pointed out, however, that since both the Ministry of Communications and the Reconstruction Committee were operating at the moment several wireless stations in the same area, it might be necessary for the Ministry of Communications later to redistribute the radio stations throughout the country. There was no indication that the Ministry of Communications contemplated the cancellation of the radio contracts concluded by the Reconstruction Committee.

NEW FIELD WIRELESS STATIONS IN MANCHURIA.—Mil.-Commissioner Pa-ying-e of Heiho, opposite Blagovestchensk, is going to erect a military wireless station at Moho on the upper Amur. At Chinshanchen and Lopei the portable field wireless is to be installed the same as at Moho.

PUBLIC TELEPHONE SERVICE IN JAPAN.—According to an investigation made by the Department of Communications, there are 605 public telephone booths in the City of Tokyo, and these telephones are realizing an income of Yen 92 a month (or the number of calls is 1,820) on an average. The total earnings in Tokyo City amount to Yen 55,700 a month or some Yen 668, 000 a year.

Public telephone income in the City of Yokohama is far less than in Tokyo, the average per month being Yen 41 a unit. Yokohama's average is the smallest among the six leading cities in Japan.

Osaka leads all other cities with some Yen 100 a month per telephone, but Osaka has only 296 public telephones in the whole city. Following Osaka, comes the City of Kobe with the average of Yen 82 a month, Nagoya with Yen 77, Kyoto with Yen 74.

Earnings of public telephone in cities other than the six leading centers amount to only Yen 33 a month. The grand average for all Japan works out at Yen 71 a month per one telephone, on which basis the total on 2,166 public telephones in all Japan is Yen 1,845,500 a year. The Department of Communications thinks that this is not a negligable source of income and it has decided to instal some 150 more this year.

POWERFUL RADIO STATION IN MANCHURIA.—In the field of reconstruction enterprises, Manchuria now has over 70,000 *li* (23,400 miles) of telegraph wires and over 500 telegraph offices. The powerful radio station which is in daily communication with Europe is regular operation, while preparations are now being made for the erection of another station for communication with America. The new radio station will cost approximately $320,000 U. S. currency.

PUBLIC WORKS

IMPROVEMENT OF SOOCHOW CREEK PLANNED.—Plans for the improvement of the Soochow Creek as the main waterway for rice transportation in southern Kiangsu, have been formuiated jointly by the Special Municipality of Shanghai and the Kiangsu Provincial Government. Surveying of the entire course will shortly be started with a view to widening the creek at various points. The entire river bed will also be dredged so as to provide for the navigation of steam launches. The cost of the conservancy work will be jointly borne by the Shanghai Special Municipality and the Kiangsu Provincial Government. The Rice Merchants' Association is also expected to bear a portion of the expenses inamuch as rice will be the chief product for transportation on the river.—*Kuo Min.*

WATER POWER RESOURCES IN KOREA.—There are 133 points where water power can be developed advantageously. The total power capacity at these points is estimated at 1,632,000 k.w. maximum , or 1,007,000 k.w. average a year. The Bureau of Electricity, of the Government General of Korea, has surveyed 90 points, out of the above total, and has ascertained that a total of 1,323,800 k.w. maximum 833,668 k.w. average a year, can be developed, Power resources at these 90 points are summarised according to rivers, as follows :

Name of River	Over 10,000 k.w.	Over 5,000 k.w.	Below 5,000 .kw.	Total k.w.
Yalu River...	3	1	1	415,347
Daineiko River	–	–	3	3,420
Seisenko River	4	2	–	90,269
Daidoko River	–	2	8	35,782
Rinshinko River	1	–	–	10,940
Kanko River	7	8	11	244,480
Kinko River	–	2	3	21,077
Tanshinko River	1	2	–	25,108
Rakutoko River	4	1	7	95,485
Gyokukei River	1	–	–	20,057
Kakoku River	–	2	–	13,759
Nandai River (Koryo) ...	1	–	–	14,256
Nanko River	–	–	1	1,268
Kokyo River	–	–	2	6,494
Josenko River	5	–	–	228,357
Nandai River (Zuisen) ...	5	–	–	83,860
Total:	32	18	40	1,323,808

NANKING-PUKOW BRIDGE.—Plans for the construction of an iron suspension bridge connecting Hsiakwan with Pukow are being formulated by Mr. Sun Hsueh-kao, Managing-Director of the Tsin-Pu Railway, for submission to the Ministry of Railways. The new bridge will make direct connection between the Shanghai-Nanking and the Tientsin-Pukow Railway lines possible so that through trains can be operated between Shanghai and Peping.—*Kuo-Min.*

$3,250,000 PENANG WATER SCHEME.—Our Penang correspondent telegraphs :—The Batu Ferringhi water scheme, which will practically double the existing supply of water, is expected to be completed during July when H. E. the Governor is expected from Singapore to declare it open. The new scheme which cost $3,250,000 is expected to supply 3,420,000 gallons per day during dry weather.

SHIPPING

FOUR O.S.K. JAPANESE LINERS.—The Osaka Shosen Kaisha had two passenger and cargo ships of about 9,400 tons gross on order, together with three smaller vessels. They have now contracted with the Mitsubishi Dockyard for four more cargo ships. They will be about 450-ft. long, the gross tonnage being 8,200 and the deadweight capacity 9,700 tons. Two 3,200 b.h.p. Mitsubishi-Sulzer engines will be installed in each ship, having six cylinders 680 mm. bore with a piston stroke of 1,200 mm. They run at 120 r.p.m. The speed on trials is to be 17 knots. No passengers will be carried.

ANOTHER D.K.K. MOTOR SHIP.—The "Tensan Maru," which is being built by the Mitsui Bussan Kaisha for the Dairen Kisen K.K., has been launched. She is 325-ft. long, with a beam of 46.5-ft. and a depth of 21.5-ft. B. and W.-type engines, constructed in Copenhagen, will be installed.

FAR EASTERN PASSENGER AND CARGO SERVICE.—The Java-China-Japan Line ordered last month two passenger and cargo ships of 14½ knots speed with single-screw Werkspoor-Sulzer machinery. Their gross tonnage is about 9,000.

FERRY FOR POOTUNG SERVICE.—Pursuant to their policy of improving the traffic conditions on the Whangpoo ferries and insuring the safety of passengers, the Bureau of Public Utilities of the Municipal Government of Greater Shanghai has ordered a new boat for the service, at a cost of $50,000. The new boat is nearly 170 feet in length and 20 feet in width. It will have a 160 h.p. Diesel engine capable of a speed of 9½ knots. With a passenger capacity of more than 400 persons, it is expected to relieve the traffic congestion which has been acute at the ferries.

A new wharf at Tungkow on the Pootung side is also being built for the convenience and safety of travellers.

URAGA DOCKYARD COMPLETES NEW MOTOR FREIGHTER.—The Kowa Maru, 9,100 tons dead weight, the first ship with Maschinenfabrik Augsburg Nuremberg type Diesel engine built in Japan, had her trial run off the Uraga Dockyard on June 20.

The freighter will be brought to Yokohama at the end of June for the inspection of those interested. She will leave Yokohama for the Pacific Coast of U. S. A. at the beginning of July under charter to the Yamashita Kisen Kaisha.

The Kowa Maru has been constructed by the Uraga Dockyard to the order of the Showa Shosen Kaisha.

AVIATION

TOKYO-DAIREN AIR MAIL INAUGURATED.—The whole aerial line connecting between Tokyo and Dairen undertaken by the Japan Aerial Transportation Company opened for mail service on June 21 with the commencement of the Fukuoka-Urusan aerial mail service as connecting link on that day.

The first plane bound south hopped off from Tachikawa at 6.30 a.m. with four mail-bags including one for abroad, and alighted at Osaka on 9.46 a.m. The postal matter addressed to Osaka and neighboring prefectures was at once unloaded for distribution.

Having loaded mail-bags going further south including those carried from Tokyo, another plane hopped off from Osaka for Fukuoka, at 10.27 a.m.

The plane carried 278 postal packets including 24 going abroad, in addition to a mail-bag from Shikoku going to Urusan.

By way of congratulation on the opening of the Tokyo-Dairen aerial mail service, the "Osaka Mainichi" sent by the first air mail 270 copies of the "Osaka Mainichi" to Keijo, Heijo, Dairen, and other cities.

SHANGHAI-NANKING AIR MAIL SERVICE.—China's first air mail line became an actuality on July 8, when the flight of Captain W. R. Henderson, former Royal Air Force flyer, ended successfully in Nanking.

Captain Henderson launched his five passenger Stinson Detroiter cabin plane into the air promptly at 12 o'clock, in spite of the muddy condition of the Hungjao airdrome field. There was approximately 400 pounds of postal matter aboard.

The air mail flyer arrived in Nanking shortly before 2 o'clock.

Air mail will be delivered to and from Nanking once a day excepting Sunday for a period of two weeks. If the experiment proves successful, arrangements will be made for the delivery both of mail and passengers twice daily.

Special air mail stamps are being sold to-day at the Shanghai head post office and sub-offices. They are in denominations of 15, 30, 45, 60 and 90 cents each.

ROADS

ROAD CONSTRUCTION IN SOUTH CHINA.—The most noteworthy development in those Provinces, states Mr. Julean Arnold, is the remarkable increase in road construction, which has resulted in a greatly enhanced importation of motor vehicles, principally of busses. Mr. Arnold reports that the Province of Kwangsi now has upward of 1,000 miles of recently constructed roads over which operate about 500 motor vehicles, of which busses form the great majority. He further estimates that in Kwangtung Province, including the Island of Hainan, about 2,000 motor vehicles are being operated.

Throughout scores of cities in South China, buildings along the main thoroughfares are fast being altered or torn down in order to accommodate motor transportation, and modern public utilities, such as waterworks and electric light and power plants, also are gradually being introduced. Mr. Arnold predicts that during the next few years the bulk of motor-vehicle imports into China will consist of motor-truck chassis to be employed, primarily, for bus and commercial purposes.